2013

Stormwater and Flood Management Financing Study in Oxford, Maryland

Prepared for the Town of Oxford, MD

Prepared by the Environmental Finance Center (EFC) for the National Fish and Wildlife Foundation

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Cover Photo: Tilghman Street on December 21, 2012. Photograph by Cheryl Lewis

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Executive Summary

The Town of Oxford is located in Talbot County on the Eastern Shore of Maryland. It is situated on the Tred Avon River and intersected by Town Creek, and lies within the Lower Choptank watershed segment draining directly into the Chesapeake Bay. Oxford has approximately 650 full-time residents that more than doubles in size during the summer months. Oxford is small in size covering only 513 total acres. The highest elevation in town is at 11 feet above mean high water with many parts of town falling between 4-10 feet above sea level. The majority of Oxford is located in a floodplain, therefore, is low-lying land frequently exposed to flooding caused by tidal and rain events resulting in recurrent flooding in many areas of town. Stormwater and tidal concerns are closely linked issues that cannot be easily separated when exploring potential solutions to manage stormwater in the town of Oxford.

Although flooding is not a new problem for people living by the water on Maryland's Eastern Shore, Oxford residents, in particular, find it necessary to pay close attention to daily weather reports and have been known to move cars to higher ground in the event of even minor rain events.[1] When rain is coupled with winds and high tides, residents can be stranded in their homes for a day or more until the water naturally recedes. The soil in much of Oxford is poorly drained resulting in visible standing water days after a weather event has occurred. Over the years, Oxford residents have acquired a tolerance for the impacts of flooding and are quite realistic in their understanding that completely eliminating flooding altogether in town is neither practical nor possible due to the natural conditions of the land and the town's geography.

Large-scale weather events such as tropical storm Isabel have brought considerable damage to Oxford and will continue to do so, but it is the increasing occurrence of medium severity weather events that has become the defining problem. While large-scale events are unavoidable and can be prepared for and smaller events are often accommodated, it is the medium size-medium frequency events that occur at a frequency of (3-6 times/year) that regularly make passage on roadways difficult and are a persistent burden for residents that seek to protect property, ensure safety, and enable travel.

Flooding does not uniformly impact Oxford's neighborhoods. The Causeway, South Morris Street, Mill Street, Tilghman Street, and Bank Street are among the most impacted locations in town. With older homes located in these higher-risk neighborhoods of Oxford, concern over damage to a home's foundation have led many residents to consider elevating their houses, which brings about a set of legal and social complications, as well as significant cost. The Mill and Tilghman Street

[1] Detailed references are provided in the body of the report. Many of the anecdotes and much of the problem description comes from one-on-one communications with citizens at town meetings.

area includes some lower income homes and some of oldest remaining African American families of Oxford. Beyond the concern of property damage itself, flooding can also have an impact on the local economy, especially for a town that relies on summer tourism and traditionally high real estate values.

Compounding the complexity of increased storm severity is the fact that Oxford's current high water issues are expected to worsen as a result of sea level rise. Projections show that the Chesapeake Bay could rise by 2.6 to 4.3 feet by the end of the 21st century with an average annual rate of 0.35 inches/year. Sea level rise is a critical factor of consideration for the Town of Oxford when making investment decisions related to stormwater infrastructure as well as community planning.

There is general consensus among Oxford residents that flooding in many areas of town has reached a point where some level of action by town officials must be taken in the near future to begin addressing the situation. To date, the town's budgetary constraints and limited staffing capacity have made it impossible to take more aggressive action towards reducing high water issues caused by stormwater, tidal events, and sea level rise. A more in-depth analysis into properly managing the problem and exploring potential solutions is considered timely and necessary.

Stormwater Management in Oxford

Oxford's stormwater infrastructure system consists of pipes, culverts, swales, rain gardens, rain barrels, outfalls, biobags, and tide gates that work together to convey or store stormwater and minimize pollution loading. The stormwater system, which is separate from the sewage system, is based on gravity flow and relies on an elevation gradient to drain water to outfalls. The low-lying configuration of the town and tidal influence diminish this elevation gradient, and the conveyance system necessitates assistance from tide gates.

Much of the stormwater system was put in place 50-plus years ago and there are components of the system which the town does not have accurate records of location, age, and condition of many of the towns pipes and culverts. Much of the town's stormwater infrastructure is located in the Historic District or at Causeway, which coincides with flooding hot spots.

In addition to the stormwater infrastructure in town, Oxford has undertaken numerous landscaping and design projects over the years that have impacted the direction and magnitude of stormwater drainage in the town. The most notable of these projects is the construction of the Causeway Park, which intersects with the main entry/exit point for Oxford and Town Creek.

Oxford's department of public works (DPW) maintains the town's stormwater system. DPW does not have an individual staff person dedicated to stormwater management, but rather a team that works on regular and emergency stormwater issues, and other public works issues, as necessary. Regular maintenance involves

cleaning the pipes and culverts of trash and leaves, which occurs twice-annually and is typically a two-day process requiring the labor of six men. There is also monthly brush pick-up and weekly leaf pick-up, which prevents debris from entering the system. Regular inspection of infrastructure occurs and repairs are made as needed. In addition to work performed by DPW, the town administrator has a number of responsibilities associated with the implementation of Oxford's stormwater program.

While there is limited information on the precise age of Oxford's stormwater infrastructure, many of the system components are believed to be approaching their useful lifetime. Past and proposed capital improvement projects are generally institutional knowledge shared among individuals from DPW and town officials. Capital improvement projects are prioritized by DPW based on a backlog queue and the urgency of a project as it relates to community safety; projects are ultimately selected and funded based on the budget decisions of the Oxford Town Commissioners. The process by which capital improvement projects are selected and ultimately budgeted must respond to the Oxford's aging and underperforming stormwater system.

Currently, financing of Oxford's stormwater program comes from the town's general fund. The program is not a separate line item in the town's budget and is embedded across multiple line items. In FY 2013, for example, the town's entire budget totaled $1.285 million with $35,000 set aside specifically for stormwater related capital improvements. The Town of Oxford adopted a stormwater ordinance in 2011 that helps shape its current stormwater program. This ordinance, along with other regulations such as Maryland's Critical Area Law and the Total Maximum Daily Loading (TMDL) limitations for phosphorus, nitrogen, and sediment also play a role in prioritizing stormwater management for the town of Oxford.

Project Approach

In order to address increasing high water concerns affecting the town and meet state regulations, officials from the town of Oxford began to gather key partners which included the University of Maryland Environmental Finance Center, the Eastern Shore Land Conservancy, the Chesapeake Bay Foundation, Preservation Green, LLC, and GMB, LLC. The partners convened to discuss Oxford's flooding and stormwater issues resulting in what eventually became the Oxford Stormwater Task Force (hereafter known as the Task Force), a title selected to indicate to the shared responsibility of the group to develop and implement a long-term plan for managing and financing Oxford's stormwater program.

The primary focus of the Task Force was to find the best tools available for addressing flooding concerns in the town. This included developing recommendations for the proper design and maintenance of existing infrastructure as well as conducting essential community outreach and financial analysis to evaluate the costs of infrastructure improvements. In addition to concerns about

water quantity, the Task Force also sought to improve water quality through the identification of certain stormwater best management practices (BMPs) that could be incorporated into Oxford's stormwater program. Although Oxford is not regulated for stormwater, the town does have water quality concerns and is actively working with Talbot County officials and the State of Maryland to improve and better manage pollution from stormwater in the future.

The project unfolded in the following three phases:

- Identify and Characterize Stormwater/Flooding Issues
- Community Education and Outreach
- Technical Analysis of Infrastructure and Funding Elements

During the first phase, feedback from the community was sought to give the Task Force a better understanding of the overall stormwater and flooding problems occurring in Oxford. Feedback from the community was solicited through neighborhood-focused meetings that included mapping exercises and written surveys. The second phase of the project was defined by educational outreach that delivered information about the importance of stormwater and practices for managing it on personal and public property. The centerpiece of the outreach phase was the "Oxford Summer Stormwater Series," which consisted of a series of presentations, workshops, and volunteer opportunities that ran from April through September 2013. Between the neighborhood stormwater discussions and the Summer Stormwater Series, the goals of this phase of the project was to ensure that citizens had a voice in the town's stormwater program and were provided an active role in mitigating the impacts of flooding.

The third phase of the project was a detailed technical analysis of Oxford's stormwater program. By looking at engineering reports and budget history, interviewing town officials, and touring Oxford through photographs and in-person, the goal was to illustrate the town's entire stormwater program from infrastructure to funding trends. The analysis included identifying gaps in the program, or areas where the program was not able to meet current or future expectations. Program gaps were compared with citizen concerns to identify the most critical problems in the town and to begin targeting potential solutions. The last piece of the technical analysis involved the exploration of technical solutions, including capital improvement projects, capacity for resolving stormwater problems, and possible mechanisms for funding the projects.

Recommendations

After collecting significant stormwater management data; organizing many outreach activities that helped gather important feedback from the community; and subsequently analyzing possible solutions and associated costs, five key recommendations for remediation of stormwater and frequent flooding were developed for the town of Oxford. Project findings and recommendations were

presented to Oxford residents, businesses, and town officials on September 24 and 25, 2013. The recommendations included:

- **Adopt a more effective stormwater budget:** Approximately $630,000 over a five-year timeframe is needed to invest in stormwater management for the town of Oxford. This amount includes implementing the currently planned capital improvement projects, a stormwater infrastructure inventory and map, as well as a stormwater Master Plan. Oxford should also consider budgeting for additional major capital improvement projects in the next 5-8 years for such things as Causeway stormwater pumps and a road elevation project, which will address an area of priority concern at a total five-year budget of approximately $1.5 million.
- **Account for projected sea level rise:** With the Chesapeake Bay projected to rise between 2.6 and 4.3 feet by 2100 at an average rate of 0.35 inches/year, Oxford should factor sea level rise projections into all major capital improvement projects. As an additional precaution, Oxford should assume some additional costs in their future budget projections. Furthermore, the town should evaluate its response to sea level rise beyond the scope of its stormwater program.
- **Establish a utility as part of a blended financing strategy:** Oxford should adopt a tiered residential and commercial stormwater utility fee as a consistent, dedicated, and equitable form of revenue to cover program costs. The utility should be supplemented by general funds and could be used as a way to leverage additional grant funding and/or competitive loan rates.
- **Designate an appropriate utility purpose and label:** Given that the frequency and severity of high water events cannot be resolved solely through a traditional stormwater program, Oxford should broaden the definition and functionality of the utility to include shoreline protection. The revenue collected through the utility should address both stormwater and shoreline drivers of high water events and water pollution. The name of the utility should reflect the multi-functionality of the revenue collected thus allowing projects to be appropriately funded through this financing mechanism.
- **Utility structure and reserve fund:** It is recommended that the town of Oxford adopt a base utility fee of $175/home/year and that an additional $100,000/year, which is currently spread across multiple line items, be allocated to the stormwater (and shoreline protection) program from the general fund. This would raise approximately $990,000 over a five-year period.

Through these recommendations, the town of Oxford has a unique opportunity to be proactive and innovative in its approach of including sea level rise into the town's stormwater management program; thus making them a statewide leader in this

respect as well as helping residents and businesses cope with high water concerns affecting the town of Oxford.

Chapter 1: Introduction

On November 27, 2012 officials from the town of Oxford and representatives from the University of Maryland Environmental Finance Center (EFC), the Eastern Shore Land Conservancy (ESLC), the Chesapeake Bay Foundation (CBF), Preservation Green, LLC, and GMB, LLC convened at the Oxford town office. The purpose of the gathering was to review the terms of the recently awarded National Fish and Wildlife Foundation (NFWF) walk-up grant, discuss Oxford flooding and stormwater issues, and outline project goals. The meeting effectively launched the Oxford Stormwater Task Force (the Task Force), a title selected to indicate to the community, the shared responsibility of the group to develop and implement a long-term plan for managing and financing Oxford's stormwater program.

Project Objectives

The discussion at the November 2012 kick-off meeting identified four stormwater problems in the town:

- Oxford's stormwater infrastructure is not well understood, which serves as an impediment to effectively maintaining and repairing the system;
- Budget limitations frequently require Oxford to defer stormwater maintenance and construction new capital improvement projects;
- The sources and types of pollution found in the town's stormwater runoff are not well understood;
- Stormwater compounds, and occasionally causes flooding in Oxford, but flooding is typically driven by tidal and storm surge events, which is a function of the town's geographic proximity to the Tred Avon River and the Chesapeake Bay.

In turn, the Task Force selected the following four objectives for the project:

- *Objective 1*: Engage citizens and businesses of Oxford in stormwater outreach and education throughout the duration of the project;
- *Objective 2*: Characterize the town's existing stormwater program and its ability to effectively manage pollution runoff and flooding;
- *Objective 3*: Identify stormwater control measures (hard and soft), and associated costs, as a means to improve stormwater management in Oxford;
- *Objective 4*: Formulate a set of recommendations for financing and implementing stormwater control measures in the town.

Project Outputs and Results

The Oxford Stormwater Task Force agreed to work together to produce outreach and technical deliverables for the town of Oxford by October 1, 2013 through a

series of three phases. In phases 1 and 2, outreach would consist of a series of neighborhood discussions, presentations at community events, and distribution of educational resources. During phase 3, technical assistance would consist of a final project report outlining the town's existing stormwater program, identification of new stormwater control measures and costs, and recommendations for financing the stormwater program.

The intended result of the project, as facilitated by outreach and technical work, was to give the Oxford Commissioners the necessary community support and technical information to proceed with restructuring their stormwater program through specific management and engineering solutions and appropriate financing strategies.

Project Approach

The project unfolded in three phases. First, feedback from the community was sought to give the Task Force a more nuanced understanding of the stormwater and flooding problems occurring in Oxford. Feedback from the community was solicited through neighborhood-focused meetings, which was consistent with the fact that stormwater concerns are geographically dispersed in the town with the cause and impact of flooding sometimes varying from street-to-street. Each neighborhood stormwater discussion featured (1) an open exchange between residents, businesses, and the EFC about stormwater and flooding in the town, (2) a mapping exercise whereby attendees could describe and plot their concerns against a large map of Oxford, and (3) a brief written survey covering stormwater on public and private land. Citizen feedback collected at the three neighborhood discussions held in January and February 2013 was used to signal priority areas for focus during the technical analysis.

The second phase of the project was defined by educational outreach. As opposed to the first phase, which was largely one-way feedback from the citizens to the Task Force, the second phase sought to deliver information on the importance of stormwater and practices for managing it on personal and public property. The centerpiece of the outreach phase was the "Oxford Summer Stormwater Series," a series of presentations, workshops, and volunteer opportunities that ran from April through September 2013. Between the neighborhood stormwater discussions and the Summer Stormwater Series, the goal was to ensure citizens had a voice in the town's stormwater program and a role in mitigating the impacts of flooding.

The third phase of the project was technical analysis of Oxford's stormwater program. By looking at engineering reports and budget history, interviewing town officials, and touring Oxford through photographs and in-person, the goal was to illustrate the town's entire stormwater program from infrastructure to funding trends. The analysis subsequently identified gaps in the program, or areas where the program was not able to meet current or future expectations. Program gaps were compared with citizen concerns to tease out the most critical problems in the town

and begin targeting potential solutions. The last piece of the technical analysis involved exploration of technical solutions, including capital improvement projects, capacity for resolving stormwater problems, and mechanisms for funding the projects. Technical analysis extended from February to August 2013.

Project Timeline

Pre-award period

- **September 2011** – A meeting to discuss stormwater issues in Oxford and in particular how they impact the historic African American community is attended by Preservation Green, LLC, CBF and EFC.
- **March 2012** – Engineer from GMB, LLC gives presentation on sea level rise and inundation in Oxford to citizens and staff from EFC and CBF; serves as catalyst for pursuing NFWF grant funding to help community.
- **August 2012** – Oxford submits grant application to NFWF.
- **October 2012** – Oxford is notified of walk-up award by NFWF.
- **October 29, 2012** – Hurricane Sandy hits Oxford (see Appendix A).

November 2012 – February 2013

- **November 27, 2012** – Kick-off meeting in Oxford where Stormwater Task Force is launched and project goals and objectives are identified.
- **December 2012** – Oxford Newsletter goes out to residents recruiting participants for the neighborhood stormwater discussions to be held at Oxford Town Office.
- **December 21, 2012** – Wind-driven flooding event in Oxford (Appendix A).
- **January 14, 2013 –** The Task Force holds a conference call to plan upcoming neighborhood stormwater discussions.
- **January 23, 2013** – Tilghman Street area stormwater discussion held with participation from approximately 35 town residents.
- **February 7, 2013** – Task Force conference call to brainstorm outreach.
- **February 18, 2013** – South Morris Street area stormwater discussion held with participation from approximately 20 town residents.
- **February 19, 2013** – Jack's Point area stormwater discussion held with participation from approximately 15 town residents.

March – May 2013

- **March 14, 2013** – The Task Force holds a conference call to finalize planning for outreach efforts including inception of the Summer Stormwater Series.
- **April 10, 2013 –** EFC staff interviews Oxford Town Administrator and Oxford Dept. of Public Works Superintendent about town's stormwater program.
- **April 24, 2013** – Oxford Day stormwater education booth; first event and official introduction of the Summer Stormwater Series to community.
- **May 14, 2013 –** EFC staff meets with Talbot County Departments of Public Works and Planning about County-owned property near Oxford.

- **May 14, 2013** – EFC staff interviews Oxford town commissioner about town's stormwater program.
- **May 14, 2013 –** EFC staff presents to the Oxford Business Association at the Masthead Restaurant including discussion of flooding and tourism in town.
- **May 30, 2013** – EFC staff interviews engineer with GMB, LLC.
- **May 31, 2013 –** River Appreciation Week in Oxford led by Talbot County Master Gardeners; second event of Oxford Summer Stormwater Series.

June – September 2013

- **June 13, 2013** – EFC interviews GMB engineer about capital projects and BMPs to manage flooding and stormwater.
- **June 19, 2013** – Rain garden and barrel workshop held for citizens at the Oxford Community Center; third event of Oxford Summer Stormwater Series.
- **June 24, 2013** – Oxford Town Administrator presents to the annual Maryland Municipal League conference in Ocean City on the topic of sustainability, climate change, and stormwater management in Oxford.
- **June 25, 2013** – EFC and engineer from GMB, LLC visit site of Dewey Beach, DE to examine Bayard Avenue stormwater control project.
- **July 17, 2013** – French drain workshop held for citizens at the Oxford Community Center; fourth event of the Oxford Summer Stormwater Series.
- **July 31, 2013** – EPA Region 3 Administrator tours Oxford and other Eastern Shore communities to learn about stormwater and sea level rise planning.
- **August 5, 2013** – EFC and GMB engineer gather to present preliminary project ideas and financing options with Oxford officials.
- **August 24, 2013** – Workshop on stormwater systems at the Preservation Green Horticultural Center open to Oxford citizens.
- **September 24 and 25, 2013** – Presentation of findings, scenarios, and recommendations to the community.
- **September 28, 2013** – Volunteer installation of a bioswale on Bank Street open to Oxford citizens.

Project Roles

The Town of Oxford was awarded a walk-up grant from the NFWF in the late summer of 2012. The grant application outlined roles for the town of Oxford, ESLC, CBF, GMB, LLC, and the EFC. The University of Maryland EFC was selected by NFWF as a pre-approved technical assistance provider to oversee project management including community events and development of this report. The formation of the Oxford Stormwater Task Force was a means to align the diverse organizations and clarify roles as well as incorporate other valuable organizations, including specifically Preservation Green, LLC and the University of Maryland Extension (see Table 1).

Table 1. Oxford Stormwater Task Force, organizations and responsibilities

Organization	Description	Points of Contact	Role
Oxford Commissioners	Body of elected officials responsible for approving budgets and adopting ordinances	Peter Dunbar, Carole Abruzzee, Gordon Graves, Gordon Fronk; *all Oxford Town Commissioners*	Help define stormwater and flooding problems and review solutions
Oxford Town Officials	Non-elected officials employed by Oxford	Cheryl Lewis, *Town Administrator* Scott Delude, *Department of Public Works Superintendent*	Help EFC understand Oxford stormwater program, assist with meeting logistics and citizen recruitment, and distribute materials to citizens and businesses
University of Maryland Environmental Finance Center	Technical Assistance Provider	Joanne Throwe, *Director* Sean Williamson, *Program Manager*	Coordinate the Task Force, arrange outreach and education events, complete technical analysis of Oxford stormwater program
GMB, LLC	Engineers with Town of Oxford	Steve Marsh, *Engineer*	Develop technical resources (e.g., maps) and review costs for engineering projects
Eastern Shore Land Conservancy	Non-profit group that promotes conservation on MD's Eastern Shore	Sarah Abel, *Community Design Manager*	Community outreach and education with Oxford citizens and businesses
Chesapeake Bay Foundation	Non-profit group that promotes saving the Bay	Alan Girard, *Eastern Shore Director*	Community outreach and education with Oxford citizens and businesses
Preservation Green, LLC	Architecture and Landscape Design Firm	Philip Logan, *Architect*	Community organization, design and technical assistance
University of Maryland Extension	Outreach and education	Mikaela Boley and Amy Scaroni, *UMD Faculty*	Stormwater management and outreach assistance

Overview of the Report

The report that follows is broken into seven chapters, including this first introductory chapter, and a set of appendices. Chapter 2 covers relevant background on Oxford's stormwater and flooding patterns including problem characterization, an overview of the existing stormwater program, and an in-depth look at neighborhoods. Chapter 3 reviews outreach and education activities that occurred over the course of the project. Chapter 4 examines stormwater program costs under a business-as-usual scenario and alternative scenarios with more management and engineering solutions more likely to significantly impact stormwater patterns in town. Chapter 5 looks at options for financing the costs associated with Oxford's stormwater program. Chapter 6 provides a detailed look at how a stormwater utility in Oxford could be equitably structured to meet the potential costs of the town's stormwater program. Chapter 7 summarizes findings, lists concrete recommendations, and concludes the report.

Chapter 2: Stormwater and Flooding in Oxford

Defining the Problem

Oxford's stormwater and flooding problems stem from its geography, history, economy, and changing climatic conditions. Located on Maryland's Eastern shore in Talbot County, Oxford lies along the Tred Avon River and is intersected by Town Creek, and lies within the Lower Choptank watershed of the Chesapeake Bay. Founded in 1683, the town's economy has long been dependent upon access to water. Oxford's protected harbors have supported shipping of agricultural goods, fishing and crabbing, and boat building. These traditional industries, which helped to sustain populations over 1,000 people, have gradually shrunk and given way to a new economy more reliant on tourism and vacationing. Oxford has approximately 650 residents including a mix of full-time and part-time (summer). [2]

In total, the town is 513 acres in size including 142 acres of submerged land. As a result of annexation, the town has more than doubled from its size of 213 acres in 1988.[3] The highest elevation in town is 11 feet above sea level with many parts of town falling between 4-10 feet above sea level.[4] The town's tidal and non-tidal wetlands, as well as their 100-year floodplains (discussed in more detail below), are characterized as sensitive areas in the town's Comprehensive Plan.

Oxford's low-lying land is frequently exposed to flooding from tidal, wind-driven, or precipitation events. Flooding may occur as a result of any single event or as a combination of events with the impacts often varying from street-to-street within the town. Retreat of floodwaters also varies geographically within the town and may be faster or slower depending on the tide, the wind speed and direction, the temperature, and local topography.

Flooding in Oxford is widely viewed as a manageable problem. From inconvenient tasks such as moving cars to higher ground ahead of exceptional high tides to the completion of paperwork for flood insurance claims after a major flooding event, residents are generally accommodating. For more than 300 years the town has accommodated flooding, and because of this history, residents of Oxford view flood events as a regular occurrence to which they can prepare and respond. One resident said the following about living in Oxford:

> *We choose to live in this town, nearly surrounded by water, subject and subservient to the forces of wind, and tide, and weather. Those of us who have lived here for awhile have adapted to those forces. We park our cars on higher ground...but it's only a block or two away. We make sure our outdoor chairs don't float or blow away. It's not unlike being on a boat, and preparing for a storm...you batten down.*

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[2] Personal communication with Commissioner Peter Dunbar. November 27, 2012 meeting in Oxford.
[3] Oxford Comprehensive Plan, 2010.
[4] Ibid; Elevation maps developed by GMB, LLC.

In fact, many of us accept -- and embrace -- the trials and challenges that living with natural forces brings. It is not a matter of just putting up with our natural environment. It makes us feel alive, and appreciative, and privileged to have this experience. And we react appropriately to ensure our safety.

In turn, characterizing Oxford's problem as flooding is inadequate; flooding in Oxford cannot be completely prevented nor should the town seek such an unrealistic goal. Instead, the problem needs to be refined to correspond with the town's risk tolerance and limited capacity to realistically improve the situation.

Low-magnitude flooding with a high frequency of occurrence on the shores of wetlands, on public spaces, or over certain low-elevation roads, therefore, is not generally viewed as a major problem in Oxford. Comparably, low-probability, high-magnitude flooding as the result of hurricanes or tropical storms (e.g., Isabel), although worrisome, are rare natural disasters that cannot be controlled. Falling between the low-probability, high-impact events that are difficult to manage, and the high-probability, low-impact events that cannot justifiably be a focus of the town's limited time and budget is a third type of flooding event – the medium-frequency, medium-impact (MF-MI) event. These MF-MI events fall between the extremes noted and are of prime concern to the town of Oxford. These MF-MI events effect specific neighborhoods severely, make passage on major town roadways difficult, and occur frequently enough to be a consistent burden to residents that seek to protect property, ensure safety, and enable travel (see Table 2).

Table 2. Types of High Water Events in Oxford

	High-Frequency, Low-Impact	**Medium-Frequency, Medium-Impact**	**Low-Frequency, High Impact**
Frequency	Monthly (Once per month)	3-4 times per Year	Once per decade
Cause	Tidal or rainfall	Combination of events such as high tide and intense rainfall or high tide and wind-driven water off the Bay	Intense wind and rain from a hurricane or similarly powerful storm; bulkheads breached throughout the town
Impact to Oxford	Significant flooding on tidal wetlands, standing water in some parks, a few inches of water on certain roads. Overall, lives' of town residents are uninterrupted.	Significant flooding in more localized areas including highly-traveled roadway. Overall, for most residents, the event poses a major interruption.	Impacts entire town; extensive flood damage to public and private property; and the town is inaccessible. Overall, this event creates a very serious interruption for town residents.

Event Comparisons

The town of Oxford is subjected to high water events from a myriad of weather and tidal conditions. The variations in storm types and the effects can be noted in three high water events that occurred during 2012 including Hurricane Sandy, the Winter Solstice storm of December 21st, and a storm on December 26th. Below is a description of the events and the contributing factors to the high waters experienced in the town (see Appendix A for pictures of flood events). The storm surge from hurricane Sandy was about a foot higher relative to normal spring tide events and the December 21st solstice storm event had water surges recorded slightly higher still. There was negligible property damage from both events and no documented risk to resident's wellbeing. Nonetheless, the way these events unfolded demonstrates just how variable high water events are in Oxford.

The December 21 event illustrates the type of flooding that is a regular nuisance for Oxford residents (see Appendix A). The flooding, which peaked at about 3 feet above mean high tide, was caused by a strong wind out of the southwest that pushed water from the Bay onto the town's western-facing shore. There was no precipitation to contribute to the flooding and there was minimal tidal influence. The wind-driven flooding was not unlike a spring tide in its depth and location. In contrast, the event on December 26, 2012 was entirely the product of precipitation. Oxford received 1.5 inches of rain over the course of 10 to 12 hours resulting in Sandy-like water levels. There was no tidal influence and the creek level remained stable throughout the rainfall, but stormwater collected in the town's trouble spots. Because the water was coming from a different direction, the distribution of high water on December 26, 2012 was different from both hurricane Sandy and the December 21 event.[5]

The high water events had the greatest impact on Oxford's three trouble spots where flooding usually occurs first and is the most severe: the main Causeway into town (State Rt. 333 or Oxford Road) extending to the South along the western edge of the Causeway park and South Morris Street, Bank Street, and Mill Street (see discussion of Oxford's neighborhoods below). For residents of Oxford, the typical protocol in the hours leading up to high-water event includes monitoring the weather forecast and tide charts closely, making any necessary trips (e.g., to the grocery store), moving valuable property to higher ground (e.g., cars), and possibly, leaving town before the flooding begins to ensure mobility and access to work or appointments.

High Water Aftereffects

Oxford's recurring high water events create a number of problems for the community beyond road flooding and sheltering of property. Flooding produces long-term physical and social outcomes that influence everything from everyday

[5] Personal communication with Peter Dunbar and Gordon Graves. Email exchange on December 27, 2012.

decisions to community relationships. As a result of poorly drained soils throughout much of the town, high water events, as well as precipitation events that do not necessarily result in high water, lead to standing water and concerns about mosquitoes, odors, and usability of one's property.[6] There is also the issue of debris such as lumber, plants, and hay bales, which is often found on roads or property after high water events.

In Oxford's historic district, along Mill, Stewart, Norton, Tilghman, and Bank Streets where flooding is widespread and homes are older, residents worry about the impact of high water on their home's foundation. This is of particular concern when wakes are formed as the result of vehicles speeding through high water. The town of Oxford has purchased and installed "No Wake Zone" road signs in sensitive parts of the community. Concerns about structural and water damage in flood-prone areas of town have led longtime and new residents to consider elevating their homes. Legal and social complications have emerged around this single issue of raising homes. In the historic district, for example, homes are required to maintain an older aesthetic, which limits a homeowner's options for raising or protecting his property. There is also a sentiment among Oxford residents that flooding is a zero sum game – if you raise your property, the water will be displaced to my property. Recently, when construction began on a vacant lot perceived as a catch basin in the historic district, residents became very invested in how high the building would stand. Citizens have expressed a range of opinions on the topic of raising buildings with some feeling the town should disallow the practice and others insisting Oxford will struggle to survive and attract new residents if the practice is not allowed.[7]

At another level, flooding can have lasting effects on the town's economy and social fabric. The town is dependent on summer tourism for much of its economy. To the extent visitors or homeowners can't access the town or simply don't want to deal with potential high water events, the town could see decreased economic activity. While most of the town's inns lie in the higher-elevation areas such as North Morris Street (Rt. 333), a number of restaurants are located adjacent to the lower-lying waterfronts and are subject to more frequent flooding. Real estate is also a thriving business in the community and many residents have purchased property in Oxford as an investment. Discussions with town real estate agents and officials suggest flooding has not adversely impacted property values, but the possibility exists. It is also worth noting that flooding, like other natural disasters, has the power to bring a community together. Because Oxford residents so regularly experience flood threats, they've learned to look out for neighbors and help those in need. The bonds formed during stressful hurricanes or high tide events have helped to make Oxford a stronger, more collaborative community.[8]

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[6] Oxford Comprehensive Plan, 2010; Neighborhood discussions, winter 2013.
[7] Neighborhood discussions, winter 2013.
[8] Neighborhood discussions, winter 2013.

Projected Sea Level Rise and Land Subsidence

Oxford's high water issues are projected to worsen as a result of sea level rise in the Chesapeake Bay and land subsidence on the Delmarva Peninsula. Geologic records demonstrate water levels in the Chesapeake Bay are not constant. Within the past 125,000 years, the Bay has experienced a high water mark 20 feet above current levels and a low water mark 410 feet below current water levels.[9] The recent trend in the Bay is increasing sea level, which has occurred at a rate of 0.12 to 0.19 inches/year and is greater than the global average around 0.06-0.12 inches/year. The rate of sea level rise is magnified by about one-third on the Delmarva Peninsula as a result of land subsidence. Portions of Oxford have reportedly subsided by as much as a foot during the last 50-100 years.[10] The scientific consensus is that the current rise in global sea levels is occurring as the result of thermal expansion and glacial melt driven by human-caused climate change.[11]

The Chesapeake Bay is projected to rise by 2.6 to 4.3 feet by the end of the 21st century with an average annual rate of 0.35 inches/year. Projecting sea level rise at a fine spatial resolution such as Oxford typically requires downscaling, or extrapolation from a larger regional scale, and is prone to significant uncertainty. Appendix B shows maps of projected sea level rise and inundation patterns in Oxford. The threat of flooding from elevated sea levels will be exacerbated by more frequent and intense storms including hurricanes and tropical storms, which are predicted to be more prevalent in the Atlantic Ocean (not necessarily the Chesapeake Bay). Precipitation is expected to be more frequent and intense during the spring and winter.[12]

Sea level rise and increased storm severity and frequency threaten Oxford. Although a comprehensive geographic assessment of Oxford's properties and their vulnerability to both sea level rise and storm surge has not been performed, the town's low-lying properties are anticipated to be inundated more often and at a greater depth this century. As a result of the outreach component of this project, numerous residents came forth with questions about sea level rise and personal anecdotes suggesting recent sea level rise on their property as well as subsidence in the town. For example, a 20-year resident at the end of Bonfield Avenue stated he once had a problem with his boat lying on its side during low tide, but he can no longer see the bottom of the boat during low tide.[13] In general, residents expressed concerns about sea level rise and a general feeling of helplessness regarding feasible solutions. Sea level rise is a critical factor that should be considered in the timing

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[9] Cronin, T.M., 2013. Science Summary – Sea Level Rise and Chesapeake Bay. USGS.
[10] Neighborhood discussions, winter 2013; personal communication with DPW Director, Scott Delude, April 10, 2013 in-person interview.
[11] Boesch et al., 2013. Updating Maryland's Sea Level Rise Projections. Scientific and Technical Working Group of the Maryland Climate Change Commissions.
[12] Najjar et al., 2010. Potential Climate Change Impacts on the Chesapeake Bay. Estuarine, Coastal and Shelf Science (86): 1-20.
[13] Neighborhood discussions, winter 2013.

and scale of all flood and stormwater management projects untaken by the town of Oxford.

The Role of Stormwater

From the start of this project, the Task Force was careful to limit its responsibilities to addressing and managing stormwater in the town. Expectations were set in communications with Oxford residents as the Task Force spelled out what could and could not be achieved through this project. The Task Force could not address all of the town's flooding concerns, including specifically, tidal and wind-driven flooding in the town, and increased threats from sea level rise. The Task Force would focus primarily on stormwater and the community could expect moderate contributions to flood control and pollution management benefits as a result.

On its own, stormwater from snowmelt or rainfall is a minor contributor to flooding in Oxford. In certain parts of town such as the northeast corner of the historic district, the local topography tends to trap stormwater and create pooling. Particularly intense precipitation events are also a problem. For the most part though, stormwater becomes a serious contributor to flooding and high water during certain high tide and storm surge events.

Regardless of causative factors such as rainfall, wind-driven water, or tidal water, the town relies on a properly designed and maintained stormwater system to convey water from private and public property to remediate the high water impacts. In turn, Oxford's stormwater program, including both the proper design and maintenance of infrastructure as well as essential outreach and financial activities, is the primary focus of the Task Force and the best tool for addressing flooding concerns in the town.

In addition to concerns about water quantity, the Task Force sought to improve water quality through identification of stormwater best management practices (BMPs) that could be incorporated into Oxford's stormwater program. Oxford does not have a regulated stormwater program. Nonetheless, the town has water quality concerns and is actively working with Talbot County and the State of Maryland to manage pollution from stormwater (see discussion below).

Oxford's Stormwater Program

What is Stormwater?

Stormwater runoff is defined by the U. S. Environmental Protection Agency as, "precipitation from rain and snowmelt events that flows over land or impervious surfaces and does not percolate into the ground. As the runoff flows over the land or impervious surfaces (paved streets, parking lots, and building rooftops), it accumulates debris, chemicals, sediment or other pollutants that could adversely

affect water quality if the runoff is discharged untreated."[14] Stormwater, unlike the wastewater that enters the sewer system via sinks, toilets, etc., generally does not go to a wastewater treatment plan. Instead, it flows underground and then is discharged into the nearest body of water.

Urban and suburban development has magnified the impact of stormwater runoff. The increase in acreage covered by impervious surfaces including roads, parking lots, houses, swimming pools, buildings, compacted soil (including many lawns) and sidewalks, has changed the land's ability to naturally absorb stormwater. Until recent stormwater legislation was passed requiring BMPs in the management of stormwater, developers built simple stormwater management systems, generally underground, to drain rooftops, parking lots, driveways, etc., in order to protect property and public safety. The stormwater eventually dumped from an exit pipe into a river, stream, bay, or ocean taking with it any pollutant picked up along the way. Storm sewer systems concentrate stormwater into straight channels, increasing the rate of flow as it travels underground. Thus, besides concerns about pollutant loads, the excessive volume leads to streamside erosion, scouring, sedimentation, and often, warmer than-usual water temperatures, all of which adversely impact natural systems.[15]

Why is stormwater important to Oxford?

- Stormwater exacerbates and sometimes causes flooding resulting in potential risks to property and public health and safety;
- Town Creek and other bodies of water Oxford resident's use for swimming and boating become contaminated with runoff from stormwater as well as flooding events;
- The network of pipes and inlets that constitute Oxford's stormwater infrastructure must be regularly cleaned and maintained, which is performed by the town's Department of Public Works and paid for with town taxes;
- Oxford's economy, which thrives on tourism and access to waterfronts with clean water, is impacted by stormwater driven flooding and pollution.

Sources of Water Pollution

Estimated quantities of nonpoint source water pollution attributable to Oxford are not available, but pollution sources and hotspots can be construed. Sources of nitrogen, phosphorus and sediment pollution in Oxford are likely consistent with other densely developed residential communities. Namely, fertilizer applied on lawns and pet waste. Of course, this is not an accusation that Oxford citizens' do not pick up after their pets, but merely an observation that the town has numerous dogs as can be verified by attending Oxford's largest annual event, Oxford Day. Oxford has

[14] National Pollutant Discharge Elimination System (NPDES), Stormwater Program, http://cfpub.epa.gov/npdes/home.cfm?program_id=6.
[15] Protecting Water Quality from Urban Runoff, EPA 841-F-03-003, February 2003, http://www.epa.gov/npdes/pubs/nps_urban-facts_final.pdf.

signs posted in its parks requesting dog owners to clean up after their pets; however, like many urban areas with tourists, full compliance is unlikely.

Nutrient and sediment loading into Town Creek, Boone Creek, and the Tred Avon is exacerbated by Oxford's proximity to these bodies of water and the frequency with which the town is inundated by high water. High water and stormwater events alike result in the capture and runoff of nutrients. Pollution derived from Oxford is not the result of a particular activity or set of bad actors, but is instead mostly a function of the town's elevation and tendency to flood. The runoff is exacerbated by high winds and tidal influences typified by coastal Oxford.

Oxford's Stormwater Infrastructure

Oxford's stormwater system consists of pipes, culverts, swales, rain gardens, rain barrels, outfalls, biobags, and tide gates that work together to convey or store stormwater and minimize pollution loading (see Table 3 and Appendix C).
The stormwater system, which is separate from the sewage system, is based on gravity flow and relies on an elevation gradient to drain water to outfalls. The low-lying nature of the town and tidal influence diminish this elevation gradient and necessitate tide gates. Tide gates are currently installed in four of the town's 15 outfalls (primarily the low-elevation outfalls) where they are supposed to prevent high tides from entering pipes, backing-up the system, and corroding metal pipes (i.e., due to salt-water corrosion).

Much of the stormwater system was put in place 50-plus years ago and there are components of the system to which the town does not have accurate records including the exact location, age, and condition of many of the town's pipes and culverts. Most of the town's stormwater infrastructure is located in the Historic District, the South Morris Street area, and Jack's Point with notable congestion around the Town Creek headwaters (i.e., at the Causeway) and in the northeast corner of the Historic District (i.e., Bank, Tilghman, Mill Streets). These locations coincide with flooding "hot" or trouble spots (see discussion below). It should also be noted that a number of culverts and pipes in Oxford have become pitched uphill and are unable to effectively convey water as the result of land subsidence in parts of town.[16]

[16] Personal communication with Scott Delude. In-person interview on April 10, 2013.

Table 3. Overview of Oxford's public stormwater infrastructure[17]

	Function	**Design**	**Location(s)**	**Other Notes**
Culverts/Pipes	Convey water under roads and driveways or to outfalls	Made of metal, PVC, concrete and ranging in diameter from 8-24"; length ranges from 4-60'	The location of all pipes is unknown, but the length of the system is likely several miles	Many of the culverts are older than 30 years old and due for replacement
Catch Basins/ Inlets	Central intake point for water before its channeled to outfall	Typically a steel grate 1.5 x 1.5'	Several exist; exact location not documented	N/A
Swales	Convey or store water alongside roadways	Open-air grassy ditch sometimes with phragmites or other plants	Along the Causeway Park, in front of Community Center, Jack's Point, elsewhere	Swales can be designed to convey or store water
Rain Gardens	Stores stormwater and supports water-loving plants	10-15 square foot plot on surface of ground	Two rain gardens at the community center	Partially funded with grants
Rain Barrels	Stores stormwater for later use	50 gallon barrels connected to downspouts	One at the Town Office and one at community garden plots	Purchased from Talbot County Master Gardeners
Outfalls	Releases stormwater into waterway	Large pipes at edge of waterway ranging in size from 12-24"	Oxford has 15 outfalls on Town Creek and Tred Avon	Many of the towns outfalls were replaced in last 7 years
Tide Gates	Prevent tide water from entering and backing-up outfall system	Multiple design types; usually a metal/plastic flap that opens when outflow pressure is greater than inflow	The town currently has 4 tide gates including Causeway Park, Pier St, Bank St, and Mill St.	Tide gates were custom made and installed by DPW
Biobag	Collects trash and other debris at the outfall before it can enter water	A large net attached to the outfall	One located at Causeway park outfall	Acquired in 2012 and paid for by Talbot County
Living Shoreline	Filters runoff and slows erosion at the shoreline	An extended strip of native plants along shoreline	The strand, the ferry dock, and waterfront park	Partially funded with grants

[17] Ibid. Does not include stormwater infrastructure on residential or commercial property such as rain gardens, green roof and cistern on Mill Street at the Preservation Green, LLC property.

In addition to the hard stormwater infrastructure, Oxford has undergone numerous landscaping and design projects that have impacted the direction and magnitude of stormwater drainage in the town. A review of engineering studies reveals the following chronology of major projects:

- **1975** – Prior to the creation of the Causeway Park, the area was a wetland; beginning in 1975 the area was filled-in with dredge material and in the 1980's the site was converted to the park with a grant from the Maryland Department of Recreation.
- **1990** – The South Oxford storm drainage project covered 25 acres of land between East Pier Street and Rhonda Avenue to the south and the Tred Avon and Bachelor's Point Road to the east. The project was designed to steer water towards the Pier St. and Causeway Park outfalls.
- **1993** – The Bonfield Avenue stormwater project installed a series of pipes and culverts and directed to the flow of stormwater towards the outfall at the intersection of Bonfield Avenue and Richardson.

Maintenance and Capital Improvements

Oxford's DPW maintains the town's stormwater system. The DPW does not have an individual staff person dedicated to stormwater management, but rather a team that works on regular and emergency stormwater issues, and other public works related issues, as necessary. Regular maintenance involves cleaning the pipes and culverts of trash and leaves, which occurs twice-annually and is typically a two-day process requiring the labor of six men. Culverts are also inspected for collapse or fragility via flow-through, hammer, flashlight, or camera tests; the results of these tests help DPW to prioritize culvert replacement schedules. The DPW also inspects the tide gates frequently to make sure they are not blocked and that tidal water is not backing up into the system. Moreover, the biobag must be installed and uninstalled annually.

Oxford does not have an extensive history of emergency repairs or purchases. For the most part, emergencies coincide with high water events and require DPW staff-time to post "High Water" road signs as well as monitor critical outfalls and flood-prone areas. High water emergencies often result in staff overtime and place moderate, but unforeseen costs on the town's budget. It should also be noted that multiple sources commended the Oxford DPW, led by superintendent Scott Delude, for their ability to respond to repair emergencies given budget limitations (see finance section below). For example, the DPW has designed and installed metal flap gate-styled tide gates for the town as a low-cost and quick alternative to purchasing a tide gate when funds were unavailable.

As mentioned above, the DPW does not currently keep digital or geographic-based records of the stormwater infrastructure condition or repair history. Additionally, there is not detailed information on the age of Oxford's stormwater infrastructure, though most of the components are believed to be approaching their useful lifetime.

As a rule of thumb, when multiple stormwater infrastructure components are installed around the same time, they reach the end of their useful life at the same time, and the next batch of infrastructure components must be replaced and financed at the same time. If most the stormwater system components were to be replaced and financed within just a few years, it would result in a glut of stormwater capital improvement projects and create a substantial strain on Oxford's finances.

Past and proposed capital improvement projects are generally institutional knowledge shared among individuals from the DPW and town officials. Capital improvement projects are prioritized by the DPW based on a backlog queue and the urgency of a project as it relates to safety; projects are ultimately selected and funded based on the budget decisions of the Oxford Town Commissioners. An incomplete snapshot history of capital improvement projects for Oxford follows[18]:

- **1980s** – Most of the town's outfalls were last replaced.
- **2000s** – Most of the town's tide gates first installed along with frequent repairs on the Pier Street and Causeway tide gates.
- **2009** – New double-vaulted tide gates installed at Bank Street and the Causeway Park.
- **2012** – Living shorelines installed at the Waterfront Park, the Ferry Dock, and along the Strand.
- **2012** – Rain garden installed at Oxford Community Center.
- **2013** – Expansion of the swale in front of the Oxford Community Center.
- **2013** – Bio-swale installation on Bank Street.
- **2013** – Installation of rain barrels at Oxford Town Office and Community Garden.
- **Ongoing** – A number of culverts and pipes are replaced annually based on a backlog list.

Over the past decade, a number of other major projects have been proposed and/or studied, but not executed, including:

- **2005** – Oxford Boatyard outfall analysis performed by GMB, LLC would reposition the outfall pipe, which conveys stormwater from Mill Street, Tilghman Street, and points below the Strand. The pipe is difficult to access and maintain because there are numerous boats on top of it; repositioning the outfall closer to Schooner's Landing would make it easier to access and would afford an opportunity to widen/clean the outfall. *The project was never completed due to funding limitations.*[19]
- **2006** – Stormwater analysis related to the proposed development of an 8,000 square foot community pool at the corner of Pier St. and Second St. The analysis, performed by Lane Engineering, found that due to the saturated conditions that already exist in the area, the pool would not increase flooding beyond what already occurs in the South Morris and

[18] Ibid.
[19] Letter to Oxford from Steve Marsh, GMB, LLC. June 20, 2005.

Pleasant St. ponding area. The recommendations were to remediate the current drainage system or develop the pool as proposed and require a stormwater management plan. *The pool was not constructed for other reasons, but study findings are relevant.*[20]

- **2006** – Streetscape study for State Route 333 along the Causeway and in the Historic District. The State Highway Administration recommended a valley gutter and reduced pavement along State Rout 333 to eliminate and/or spread ponding. *The project never took place due to inability of town and SHA to agree on project design.*[21]
- **2007** – A more comprehensive analysis of stormwater in the South Morris area following-up from the 2006 pool study. Performed by Lane Engineering, the analysis found that the area at corner of Pier St. and Second Avenue is physically depressed and often saturated as a result of the low elevation of the Pier St. outfall and frequent tidal influx. *It was recommended that land near the study area be set aside to dewater or store stormwater.*[22]
- **2011 & 2012** – Building off the Lane Engineering study that recommended adding water storage capacity to the South Morris Street area, the town submitted a proposal to the NFWF in consecutive years to acquire grant funding that would support the construction of a wetland. *The proposal was not accepted.*[23]

In addition to work performed by the DPW, the town administrator has a number of responsibilities associated with the implementation of Oxford's stormwater program. Specifically, the town administrator is responsible for upholding state laws and local ordinances with direct or indirect stormwater objectives including, but not limited to, Oxford's stormwater ordinance, the Maryland Critical Area law, and environmental site design (as a requirement of the town's stormwater ordinance, see discussion below). The town administrator also works with state and county officials in coordinating project permitting, in attaining the services of engineers for stormwater work, and in budgeting and financing stormwater projects. Finally, in 2013, the Oxford town administrator participated in a Stormwater Inspection Course offered by the National Stormwater Center. An estimated 10-20 percent of the town administrator's time is spent on stormwater related work.[24]

<u>Financing</u>

Financing Oxford's stormwater program comes from the town's general fund. The program is not a separate line item in the town's budget, but instead embedded

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[20] Letter from William Stagg to Oxford Commissioners dated August 29, 2006.
[21] Notes from Commissioner's meeting on September 26, 2006.
[22] Lane Engineering, 2007. Final Report on Proposed Pool Development.
[23] National Fish and Wildlife Foundation grant application, 2011 and 2012.
[24] Personal communication with Cheryl Lewis, town administrator. In-person meeting on April 10, 2013.

across multiple line items. The DPW, General Government (i.e., the town administrator), and even the Departments of Public Safety and Recreation have stormwater-related responsibilities (i.e., protection during high water events and trash pick-up, respectively). The town has not historically disaggregated stormwater related expenses and it is difficult to estimate how these expenses might be allocated across existing departments and programs. General government and the DPW are allocated most of the stormwater program funds for operation and maintenance.

In FY 2013, the town's entire budget totaled $1.285 million with $35 thousand set aside specifically for stormwater related capital improvement projects including culvert replacement and a new tide gate at the Caroline Street outfall, which was deferred. In FY 2009, the last time the town had a comprehensive budget audit, approximately $19 thousand was set aside for storm drain management (assumed to be capital expenses and not O&M). The town's general fund is primarily financed through property taxes (~75% of revenue in FY 2012) with intergovernmental revenue, rents, interest, licenses, and permits making up most of the difference.[25]

In addition to the town's general fund, Oxford's enterprise fund is dedicated to covering expenses associated with the town's sewer system and wastewater treatment plant. There is natural overlap between the town's wastewater system and its stormwater system, particularly with regards to the equipment needed to maintain both systems. In turn, equipment financed through the enterprise fund such as backhoes, a jetting system for cleaning the sewer pipes, and a recently purchased camera for examining the condition of pipes, is used on both the wastewater and stormwater systems. The enterprise fund is financed through a monthly wastewater utility bill paid by Oxford homeowners.

State and Local Regulations

The Town of Oxford is subject to state and local regulations that constitute or shape its stormwater program. Chief among these regulations is the town's stormwater ordinance. Adopted in 2011, the ordinance's purpose is to, "protect, maintain, and enhance the public health, safety, and general welfare by establishing minimum requirements and procedures that control the adverse impacts associated with increased stormwater runoff." [26] The ordinance includes environmental site design restrictions and encourages the use of BMPs consistent with the 2000 Maryland Stormwater Design Manual. Enforcement of the ordinance, usually in the event of land modification, is the principle responsibility of the Oxford Town Administrator. For example, prior to gaining permission to construct a home in Oxford, the town may require the development of a stormwater management plan that will minimize adverse stormwater impacts.

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[25] FY 2009-2013 Oxford Budget and 2009 detailed budget audit.
[26] Oxford Commissioners, 2011. Ordinance number 1013 (stormwater ordinance). Adopted August 1, 2011.

The State of Maryland enforces a number of other regulations, which impact Oxford directly or indirectly. Maryland's Critical Area Law, which addresses the impact of land development on fragile shoreline and aquatic ecosystems, requires the town of Oxford to review and approve land modifications in the buffer area. Most of Oxford is located within the state designated critical area. One of the most relevant applications of the Critical Area Law pertains to the construction of bulkheads, living walls, and other structures that stand between a body of water and land. It is generally against Maryland State policy to authorize the construction of new bulkheads or to replace bulkheads in disrepair with similar structures because they disrupt the intertidal zone.[27]

The state is also subject to total maximum daily loading (TMDL) limitations for phosphorus, nitrogen, and sediment, and has sub-allocated TMDL limitations down to the county level. As one of four incorporated areas in Talbot County, Oxford is a key stakeholder in the County's watershed implementation plan (WIP) for meeting its TMDL goals.[28] Through ongoing conversations between Talbot County and Oxford, it has been proposed that Oxford contribute to reductions in the amount of nitrogen and phosphorus delivered to the Bay. Talbot County is currently preparing a set of mini watershed implementation strategies for Oxford and other county towns.[29] Oxford is prepared to work with the County to meet or exceed its share of TMDL goals in a timely and cost-effective manner.[30]

The town of Oxford is also subject to TMDLs associated with its wastewater treatment plant and national pollution discharge elimination system permit. In 2003, Town Creek was listed as an impaired waterway and is subject to local TMDLs for nitrogen, phosphorus, and biological oxygen demand.[31] The town has evaluated options for enhanced nutrient reduction (ENR) upgrades to its WWTP and is on track to either upgrade the plant or find an alternative location to process sewage in the next decade. The costs associated with forthcoming ENR upgrades to Oxford's WWTP are pertinent to the town's stormwater program and ultimately affect options for financing the stormwater program (discussed in more detail below).

Finally, given Oxford's status as a boating community, it should be noted that the town is required to develop a plan for dealing with grey water from boats by December 31, 2013.[32]

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[27] Maryland Department of the Environment, 2008. Shore Erosion Control Guidelines for Waterfront Property Owners. Available at: http://www.mde.state.md.us/programs/Water/WetlandsandWaterways/Documents/www.mde.state.md.us/assets/document/wetlandswaterways/Shoreerostext.pdf.
[28] Talbot County, 2011. TMDL's and Watershed Implementation Plan. Available online: http://www.talbotcountymd.gov/uploads/File/P&Z/TMDL_WIP.pdf.
[29] Talbot County Watershed Implementation Strategies. 2013. Draft version.
[30] Personal communication with Commissioner Peter Dunbar. In-person meeting on May 14, 2013.
[31] Oxford Comprehensive Plan, 2010.
[32] Personal Communication with Cheryl Lewis, town administrator. Email exchange on July 2013.

Oxford Stormwater and Flooding Concerns By Neighborhood

The town of Oxford retains land use planning authority and "maintains a planned pattern of development within the Town's existing corporate boundaries."[33] Among other land use types, the town contains residential, commercial, maritime, and public space properties. Oxford can be segmented into five distinct areas, or neighborhoods, which are outlined in the town's 2010 Comprehensive Plan (see Map 1). The history, geography, and land use of these neighborhoods varies, which impacts how flooding and stormwater affect each area, and necessitates a careful look at each neighborhood (see Table 4).

To this end, during the winter of 2013, three neighborhood discussions were held in Oxford focusing on the Tilghman Street/Historic District, the South Morris Street area, and Jack's Point (see details in Chapter 3). These distinct areas of Oxford were identified as the most troubled by stormwater and high water issues. Based on a survey administered during and after the meetings, the following statistics were garnered:

- 82 percent of survey respondents found stormwater in the town to be of a serious or moderate concern (Number of respondents = 56)
- 62 percent of survey respondents said streets in the South Morris area were the most impacted by stormwater, followed by Historic District streets (e.g., Norton, Bank and Mill streets) as reflected in 20 percent of survey respondents.

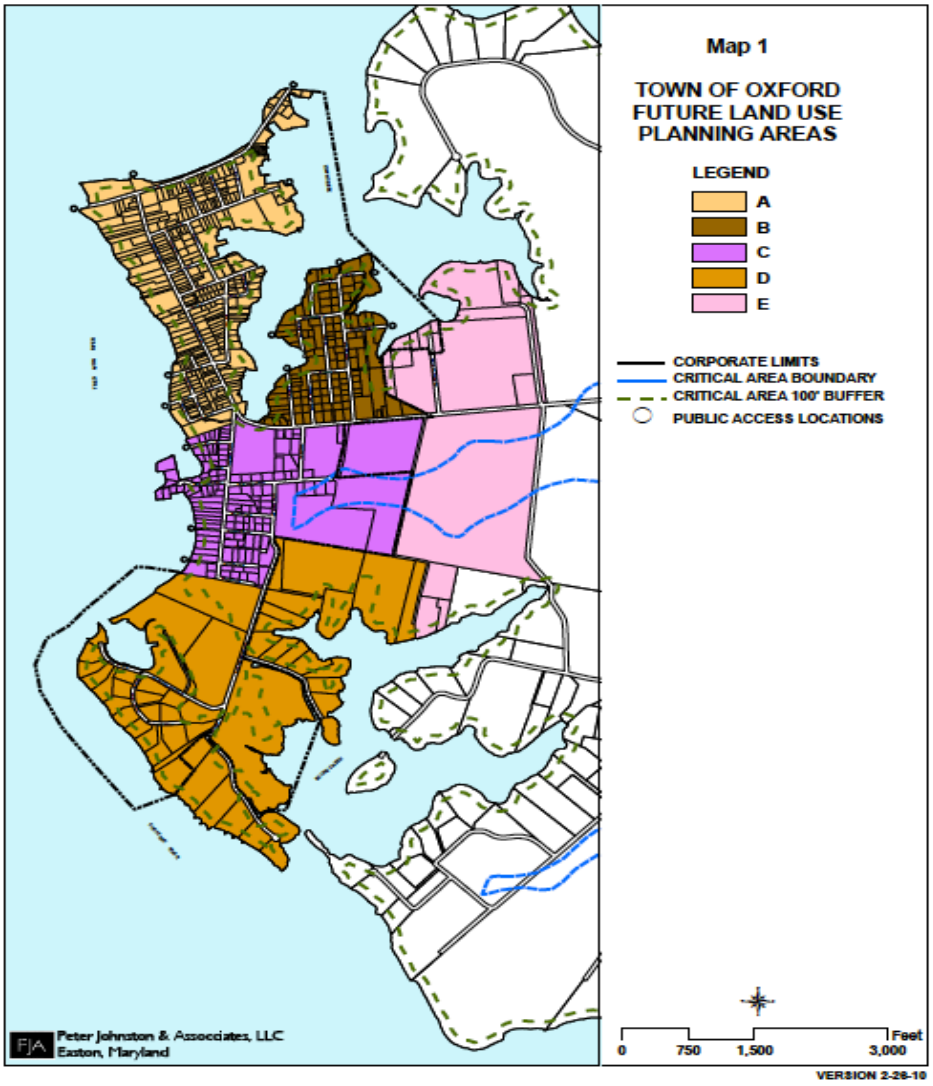
The analysis of Oxford neighborhoods and stormwater concerns, listed in Table 4 below, was identified through these neighborhood discussions and interviews with Oxford's DPW superintendent and engineers from GMB Associates.

Table 4. Summary of neighborhoods, sensitive areas, and critical factors

Neighborhood	Sensitive Areas	Critical Factors
Historic District *(Section A on Map 1)*	Tilghman, Mill, Norton, Stewart, and Bank Street	1. Performance of Mill St. outfall and tide gate 2. Bulkhead height/presence
Jack's Point *(Section B on Map 1)*	Tidal inflow areas at either end of Town Creek Road	1. Surface level storm drainage 2. Tidal inflow
South Morris Street Area *(Section C on Map 1)*	The Causeway and the Causeway Park along S. Morris Street; SW-facing waterfront homes	1. Change in size and coverage of drainage basins 2. Water storage capacity at and near park
Bachelor's Point *(Section D on Map 1)*	SW-facing waterfront homes and northern edge near WWTP	1. Performance of drainage ditches into Boone Creek
S. Morris Extended and Hels Half Acre *(Section E on Map 1)*	Evergreen Road property	1. Evergreen Road agricultural property and contribution to stormwater on Causeway

[33] Oxford Comprehensive Plan, 2010.

Map 1. Oxford Neighborhoods[34]



Tilghman Street and the Historic District (Area A on Map 1)

Area A (see Map 1) is the heart of Oxford as it includes the town's Historic District and main thoroughfare, North Morris Street (also known as Oxford Road and State Rt. 333). The area is home to most of the town's residents and many community assets such as the Oxford-Bellevue Ferry launch, the Muse, churches, and numerous inns, as well as public resources such as the town museum, library, and the waterfront park. Additionally, most of the town's boatyards and marinas can be found in this area of town including the Oxford Boat Yard, the Tred Avon Yacht Club, Cutts and Case, Hinckley's, and Mears. The Historic District is subject to special zoning restrictions, overseen by the Historic District Commission, which are designed to preserve the neighborhood's historic character.

[34] Oxford Comprehensive Plan, 2010.

Map 2. Historic District with Bank Street (in red), Tilghman Street (in blue), and Mill Street (in orange)

The Historic District is more densely developed compared to other parts of town and has few natural areas to store stormwater; most stormwater is immediately conveyed towards Town Creek or the Tred Avon. The northern edge of the Historic District area, or the Strand, is the town's highest point at about 11 feet above mean high water.[35] Most of the Historic District slopes to the south and east from the Strand towards Town Creek. Areas to the west of North Morris Street and north of the Strand drain into the Tred Avon River. The soil in the Historic District, like most of Oxford, is marine-based silt and silty clay, which does not drain well, and results in ponded waters. Much of the local soil consists of oyster shell landfill, a remnant of the old crabbing houses that operated here. According to citizens, the soil becomes extremely dry and impermeable during the hot summer months and extremely wet, but also impermeable during the rainy winter months.[36] Much of the waterfront in the Historic District is protected by bulkheads, which are generally effective at preventing tidal and storm surge flooding depending on the location (see App. C).

The area includes a number of outfalls including the Bank Street outfall, the Tilghman J-Dock outfall, and the Mill Street/Oxford Boatyard outfall. The Bank Street and Oxford Boatyard outfalls have tide gates installed. There is also a swale

[35] GMB, LLC, 2013. Maps developed for neighborhood discussions.
[36] Oxford neighborhood discussions, winter 2013.

that runs along the south side of Tilghman Street, which typically stores water until the tide recedes at the Bank Street and Oxford Boatyard outfalls.[37]

The most frequent and severe flooding in the Historic District occurs in the northeast corner alongside Bank, Tilghman, Norton, Stewart, and Mill Streets (see Map 2). The elevation along these roads is around 4 feet above mean high water with some areas below 2 feet. Stormwater frequently runs from higher elevations along the Strand or North Morris Street and collects in these locations. Depending on the circumstances, flooding can occur solely as the result of stormwater or tidal events, and is worse when high tides and precipitation occur concurrently. High water conditions are also impacted by high winds.

Two factors were identified as compounding stormwater collection and removal on Tilghman, Norton, Stewart and Mill Streets. First, there are portions of Town Creek waterfront along Tilghman Street that serve as a natural channel for stormwater exiting town as well as an entry point for particularly high tides. In some areas, bulkheads are absent and particularly high tide events are able to enter and inundate low-lying areas. Conversely, other areas have bulkheads in place, which in the event of significant storm events, prevent the outflow of water and results in pooling. Storm and tidal events may also be concurrent in which case stormwater is pushed back at the shoreline and compounded by tidal inflow. This is not a uniform problem along Tilghman Street, but occurs in certain low points that serve as inflow/outflow channels.

The second compounding factor is the performance and condition of the Mill Street/Oxford Boatyard outfall and tide gate. Also known as the Oxford Boatyard outfall because it lies beneath the boatyard, the outfall is difficult to access for regular cleaning and maintenance as a result of dry-docked boats in the yard. This situation was recognized as early as 2005 when GMB associates conducted a preliminary cost analysis of re-positioning and extending the outfall towards Schooner's restaurant.[38]

While regular DPW tests confirm that water is running through the outfall (i.e., there is no blockage), there are problems noted which possibly reflect the design and size of the outfall is likely not optimal whether the result of original design or regular wear-and-tear. Furthermore, the tide gate at Mill Street is a basic metal flap tide gate and, based observed performance relative to other doubled-vaulted concrete tide gates at Bank Street and the Causeway, does not perform consistently to convey waters.

The Mill Street area, including Mill Street, Norton Street, and Stewart Street (to a lesser degree), is a low point in the Historic District and a natural collection basin for stormwater. Until stormwater can be effectively removed via an outfall to Town

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[37] Personal communication with Scott Delude, DPW Director. In-person meeting on April 10, 2013.
[38] Letter to Oxford from Steve Marsh, GMB, LLC. June 20, 2005.

Creek and a capable, fully functioning tide gate prevents tidal backflow up the outfall, ponding and more severe flooding will occur in the area. A number of citizens have raised concerns about the recent developments on Mill Street. In particular, citizens have voiced concerns that the elevation of the properties removed a stormwater sink, effectively displacing stormwater to neighboring locations. In contrast, other area neighbors reported that stormwater ponding has decreased in the area with property landscaping, which incorporated green infrastructure capable of water storage and absorption (see Appendix C). The stormwater impact of this particular development is unknown and is outside the scope of this project. However, concerned citizens in the Mill Street area should understand that the primary cause of flooding is the effectiveness of the Oxford Boatyard/Mill Street outfall and associated tide gate, coupled with the fact that the area is a natural basin – water will accumulate if an efficient outfall is unavailable.

Bank Street is among the lowest areas in town including elevation points at just 0.5 and 1 foot above mean high tide.[39] Moreover, the elevation falls quickly towards Bank Street from North Morris Street two blocks to the west, which stands at 8 to 8.5 feet above mean high tide. Between stormwater contributions from points to the west, and Town Creek to the east, Bank Street is exposed to both rain and tidal flooding. Stormwater collected along Bank Street should be channeled towards the Bank Street outfall, which runs along Post Office Street. The double vaulted concrete tide gate installed at the Bank Street outfall performs well and does not allow the backflow of tidal water.[40] Nonetheless, given the extremely low elevation of Bank Street, the inbound tidal pressure placed on the tide gate during high tide events is substantial and difficult to overcome by the outbound stormwater pressure. During the worst flooding events, when water overcomes the bulkheads at Hinckley's, the tide gate does not function. In turn, the confluence of high tide events and precipitation makes it particularly difficult to dewater the Bank Street area.

Jack's Point (Area B on Map 1)

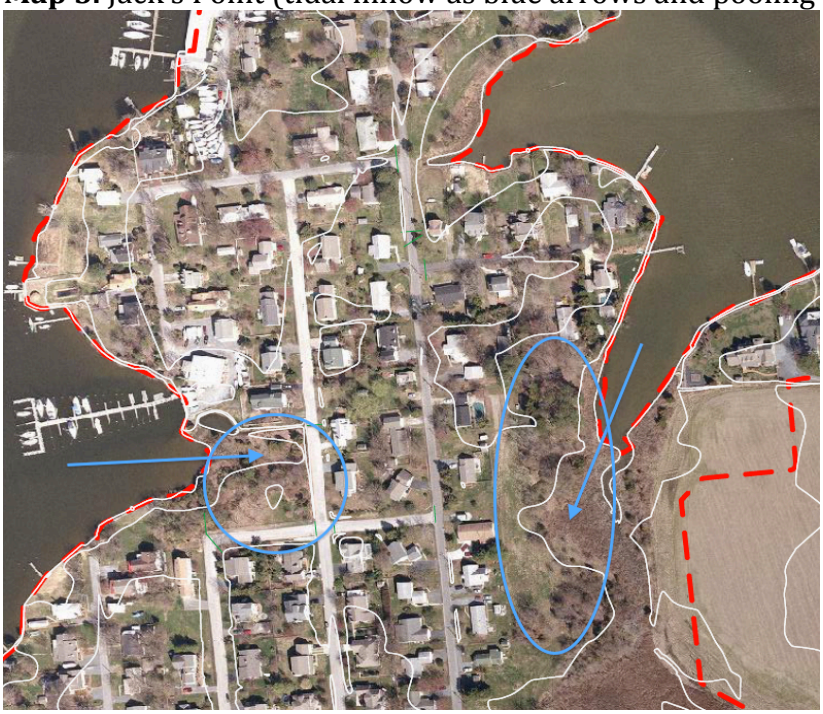
Jack's Point is a peninsula enveloped by Town Creek. The area is almost entirely residential with the exception of some maritime zoning along Town Creek that includes Campbell's Boatyard at Jack's Point. In a more recently developed area of Oxford, the plots in Jack's Point are larger than the Historic District, and cover approximately 10,000 square feet. Compared to the Historic District, Jack's Point has more undeveloped space, particularly along the eastern boarder, which the town has considered for future in-fill development.[41] The undeveloped space provides some function in stormwater remediation.
Flooding on Jack's Point occurs as a result stormwater and tidal events. Compared to other areas of town, Jack's Point has fewer culverts and limited underground outfall capacity. The southwest corner of the area drains towards the Causeway and into

[39] GMB, LLC 2013. Maps developed for neighborhood discussions.
[40] Personal communication with Scott Delude, DPW Director. In-person interview on April 10, 2013.
[41] Oxford Comprehensive Plan, 2010.

the Causeway outfall while much of the remaining portion of Jack's Point is served by the outfall at the intersection of Bonfield Avenue and Richardson, which was installed in the mid-1990s.[42] Most drainage in Jack's Point occurs along the surface. In the center of the peninsula, low points in the landscape collect stormwater and homeowners have installed French drains to dewater their property. Compounding the problem, perhaps more so than other areas of Oxford, are the soil conditions on Jack's Point. Between the clay and oyster-fill composite soil freezing during the winter and hardening during the summer heat, there is little capacity for the soil to absorb stormwater.

Adding to the high water issues from lack of water absorption and underground drainage capacity on Jack's Point, is tidal flooding. On the eastern side of the peninsula along Bonfield Avenue, tidal wetlands drain stormwater from the Hels Half acre area and Jack's Point, resulting in Town Creek to move upland during high water events (see Map 3). On the west side of Jack's Point adjacent to the intersection of Town Creek Road and Jack's Point Road, another wetland area allows for tidal inundation. The two tidal wetlands at Jack's Point are further removed from roads and homes. The tidal wetlands in Jack's Point also consist of sufficient space and native plants to store and absorb both tidal water and stormwater. Without these tidal wetlands to provide a buffer and water storage/absorption capacity, tidal flooding would likely be worse in Jack's Point. Other portions of Jack's Point, not protected by the wetlands, are afforded some protection by bulkheads, which can be breached during high tide and storm surge events.

Map 3. Jack's Point (tidal inflow as blue arrows and pooling as circles)



[42] Personal communication with Scott Delude. In-person interview on April 10, 2013.

South Morris Street (Area C on Map 1)

The South Morris Street area includes the Causeway adjacent to Town Creek, the Causeway Park and properties to the south and west along the Tred Avon, and State Route 333, the primary road into and out of Oxford. To the east of the Causeway, the area includes community assets such as the fire station and the Oxford community center, and is bordered by county-owned agricultural land (discussed further below). The town's wastewater treatment plant is in the southeast corner of the South Morris Street neighborhood. The area includes residential and commercial properties including Pope's Tavern and the Oxford Inn, the Masthead Restaurant, and the community-owned Pier Street Marina. The National Oceanic and Atmospheric Administration Cooperative Oxford Laboratory, owned by the federal government, sits at the south end of the area.

In addition to the community assets described above, the South Morris Street area includes a dense concentration of stormwater infrastructure. There are two outfalls at the Causeway, two outfalls along South Morris (at 315 and 317 S. Morris), and an outfall at Pier Street. The first four outfalls drain to Town Creek while the latter flows to the Tred Avon. The Causeway outfall has a double-vaulted tide gate in place as well as a biobag. The Pier Street outfall has a basic flap-style tide gate. Furthermore, there are natural and manmade stormwater collection and absorption areas surrounding the Causeway Park including a bioswale with phragmites along the western edge of the park and some marshy spots with phragmites bordering the parks' eastern edge.

Flooding in the South Morris Street area is among the most severe and burdensome in the entire town. At its worst, flooding events cover State Route 333, or the Causeway, and make exiting/entering the town dangerous. Due to the fact that flooding on this road is frequent, and almost all Oxford citizens use the road, the Causeway is the primary flooding concern for the town adversely affecting normal traffic patterns and emergency egress. Flooding is typically driven by stormwater collection and lack of absorption in the Causeway Park. Water will first accumulate in the swale and along the western edge of the Park along South Morris Street, Pleasant Street, and Pier Street. Intense rainfall often forms "Lake Oxford" along this western strip of the Park and can prevent residents on Pleasant Street from exiting (see Appendix C). The lake eventually dissipates as water exits towards Town Creek via the Causeway outfall, but the low-lying western edge of the Park traps and ponds some water making dewatering a slow process (see map 4).

Map 4. South Morris Street area outfalls (in red), Lake Oxford (blue circle), and swale (as the dark strip inside along South Morris Street)

While the formation of Lake Oxford is typically driven by stormwater, tidal events, storm surge and high winds can exacerbate local flooding. Storm surge can place additional water in the South Morris drainage basin while high tide events create backpressure on the Causeway outfall preventing the lake from dewatering. The confluence of storm events and high tide often results in an expanded version of Lake Oxford that can inundate State Route 333. Note that the South Morris Street area faces the Tred Avon to the southwest – windblown water from the Bay enters the area at waterfront property. Tidal water does not regularly overtake the bulkheads along the Causeway or the rest of the South Morris Street area, but there is precedent.

A number of factors compound the flooding issues in the South Morris Street area. A 2006 study by Lane Engineering, performed to evaluate the impact of a community pool development, found that (1) the area is poorly drained with less than adequate outfall opportunities; (2) the area is divided into three sub-watersheds (the north draining to Town Creek, the South to Boone Creek, and the west to the Tred Avon); and (3) the area is very saturated equating to impervious surface like conditions throughout.[43] It should also be noted that the capacity of the Causeway Park to absorb and store water has changed substantially through the years. The Causeway Park was constructed in the late 1980s atop an old dredge spoils location with financial support from the Maryland Department of Parks and Recreation (see

[43] Lane Engineering, 2007. Final Report on Proposed Pool Development.

Appendix C). As the area transitioned from a marshy tidal overflow for Town Creek, to a dredge location filled with hard clay-like soils, the location may have lost some capacity to absorb and store water.

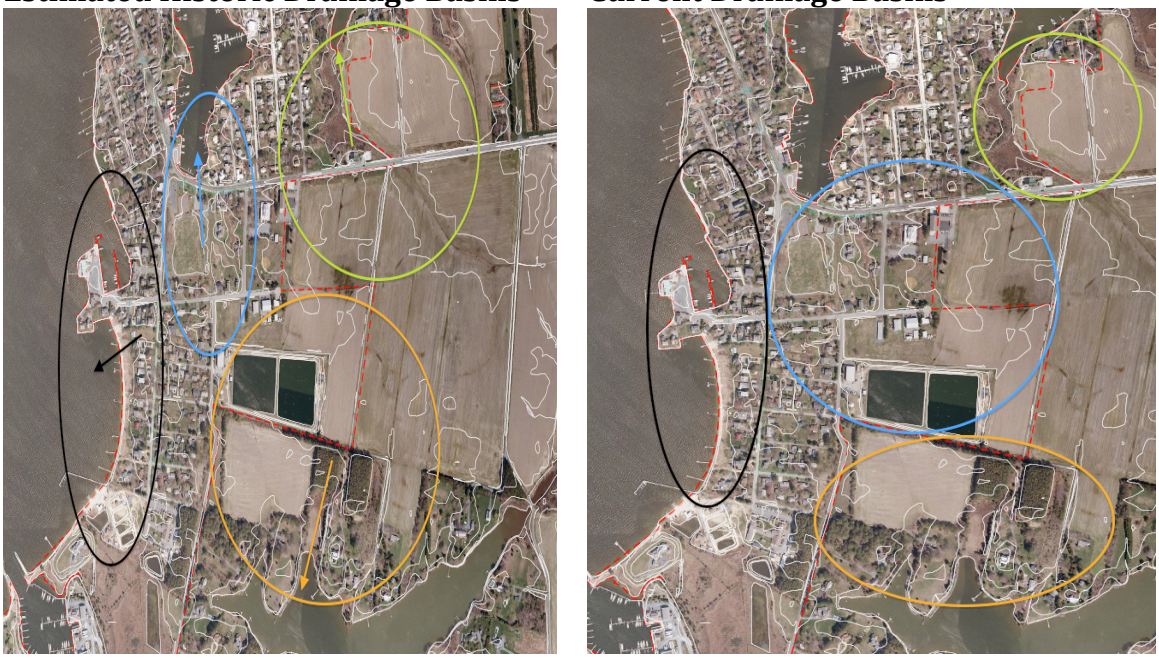
Out of this history comes the first major problem facing the South Morris Street area: a lack of natural water storage capacity aggravated by impermeable clay-based soil in the Causeway Park. Oxford recognizes this issue and has explored options for creating additional water storage and absorption in and around the park. Specifically, the town submitted a grant proposal to the NFWF in 2011 and 2012 to receive funding to develop a constructed wetland adjacent to the park which would store and filter stormwater prior to entry into Town Creek.[44] Both grant applications were unsuccessful. Other engineered options have been discussed in lesser detail including the installation of a cistern underneath or adjacent to the park and/or rain-scaping the perimeter of the park to enable more absorption/storage of stormwater (see discussion of engineering solutions below). All stormwater management solutions that impact the functionality of the Causeway Park, as well as the quality of life of property-owners surrounding the Park, will need to be carefully evaluated.

The second major problem facing the South Morris Street area involves long-term changes in the size and performance of the three sub-watersheds in the area. There is reason to believe that in the past, the Town Creek sub-watershed feeding into the area at the Causeway Park was smaller and therefore drained less stormwater (see Map 5). If the eastern branch of Town Creek is considered, which drains the agricultural area to the east of Oxford near Hels Half Acre road and the Evergreen Road property to the south of State route 333, then a fourth sub-watershed comes into play. Both the Causeway drainage area and the Hels Half Acre drainage area, drain into the Town Creek, but at different branches.

[44] National Fish and Wildlife Foundation grant application, 2011 and 2012.

Map 5. Historic and current drainage pattern at four South Morris Street area sub-watersheds including the Causeway (Blue), Hels Half Acre (Green), Tred Avon (Black), Boone Creek (Orange)

Estimated Historic Drainage Basins **Current Drainage Basins**



As a result of multiple factors, the Causeway drainage basin feeding into Town Creek (the blue oval above) has expanded to cover more of the land previously drained into Boone Creek and the Hels Half Acre branch of Town Creek (see Map 7). An additional complicating factor is land subsidence at the southern end of the Causeway drainage basin, near the intersection of E. Pier St. and J.L. Thompson Dr. Although subsidence is difficult to demonstrate, there is some anecdotal evidence to suggest it is a factor. Namely, Oxford DPW has run some drainage tests by blocking the drainage ditch at the intersection of E. Pier St. and J.L. Thompson Drive. The result is water drainage to the south towards Boone Creek, rather than water flowing from the community garden plots north towards Town Creek, which is the normal course of drainage. By removing this additional stormwater load of drainage from Boone Creek to Town Creek, the magnitude of Lake Oxford could be reduced.

An additional source of stormwater loading in the Causeway Town Creek drainage basin is maintenance and performance of drainage ditches. When drainage ditches are not regularly cleaned or removed of debris, they become clogged and ineffective at draining stormwater. Overtime, the water may reroute to a path of lesser resistance, essentially shifting the size and effectiveness of drainage basins. This is a likely dynamic with the Hels Half Acre drainage basin as there is a ditch that runs south to north across the agricultural land south of State Route 333, under the State Route 333, and eventually into the marshy land near Hels Half Acre road. Historically, the ditch carried stormwater into the Hels Half Acre drainage basin. As

this land has gone out of agricultural use and changed owners (now owned by the county), the ditch has filled in and is no longer functional. Relative to the past, the result is that more stormwater from the agricultural land to the south of State Route 333, runs west along the roadside ditches and into the Causeway Town Creek drainage basin rather than discharging in the Hels Half Acre sub-basin. There is a similar drainage ditch maintenance issue associated with the Boone Creek drainage basin (discussed below). As the drainage basins in the South Morris Street area have shifted over the years, the amount of stormwater being loaded into the Causeway Town Creek outfall has increased and magnified the existing issue of insufficient storage capacity.

Bachelor's Point (Area D on Map 1)

In 1993, 90 acres of land at Bachelor's Point was annexed to Oxford, and in 2009, another 142 acres of submerged land in the area was annexed. Most of the submerged lands are critical wetlands only suitable for wildlife habitat.[45] Bachelor's Point includes primarily residential properties, which can be distinguished from the rest of Oxford by the larger lot sizes and newer home styles. Campbell's Bachelor's Point Yacht Company and marina is located in Bachelor's Point.

During the course of discussions with Oxford town officials and residents, there was little concern conveyed with regards to the Bachelor's Point flooding and stormwater management. The infrastructure in the area is relatively new and performs well.[46] There are two factors unique to Bachelor's Point, which should be explored in greater depth. First, the southwestern edge of the point faces the Bay directly and is where most of the homes are concentrated (see map 6). In the event of storm surge or wind driven flooding (e.g., December 21, 2013 storm), water from the Bay is typically pushed in a northeasterly direction making this part of Bachelor's Point particularly vulnerable. No major flooding incidents at Bachelor's Point were recorded as a part of this project. The shoreline of the South Morris area of Oxford is presently more susceptible to storm surge than Bachelor's Point because of the size, condition, and inconsistent use of bulkheads. All things being equal with regards to shoreline protection, however, the Bachelor's Point area appears to be more exposed to wind driven or storm surge flooding.

The second factor pertaining to Bachelor's Point is a drainage ditch along the north side of the area, bordering the wastewater treatment plant (see map 6). The drainage ditch, which serves as an inflow for Boone Creek, is owned and maintained by Talbot County. Both citizens and Oxford DPW have questioned the performance and condition of this drainage ditch. The town should work with the county to ensure the land to the east and south of the wastewater treatment plant is being properly drained towards Boone Creek and not adding to stormwater loading in Town Creek.

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[45] Oxford Comprehensive Plan, 2010.
[46] Personal communication with Scott Delude, DPW Director. In-person meeting on April 10, 2013.

Map 6. Bachelor's Point (storm surge direction in red, and Boone Creek inflow in blue)

South Morris Street Extended and Hels Half Acre (Area E on Map 1),

Land east of the town, in unincorporated Talbot County, has historically been used for agricultural purposes. This area also includes the Oxford cemetery and Hels Half Acre, a marshy territory to the north along Town Creek. Under Talbot County's Comprehensive Plan this area is listed as Oxford's growth area. However, Oxford does not plan on developing the area in any significant manner in the near future.[47]

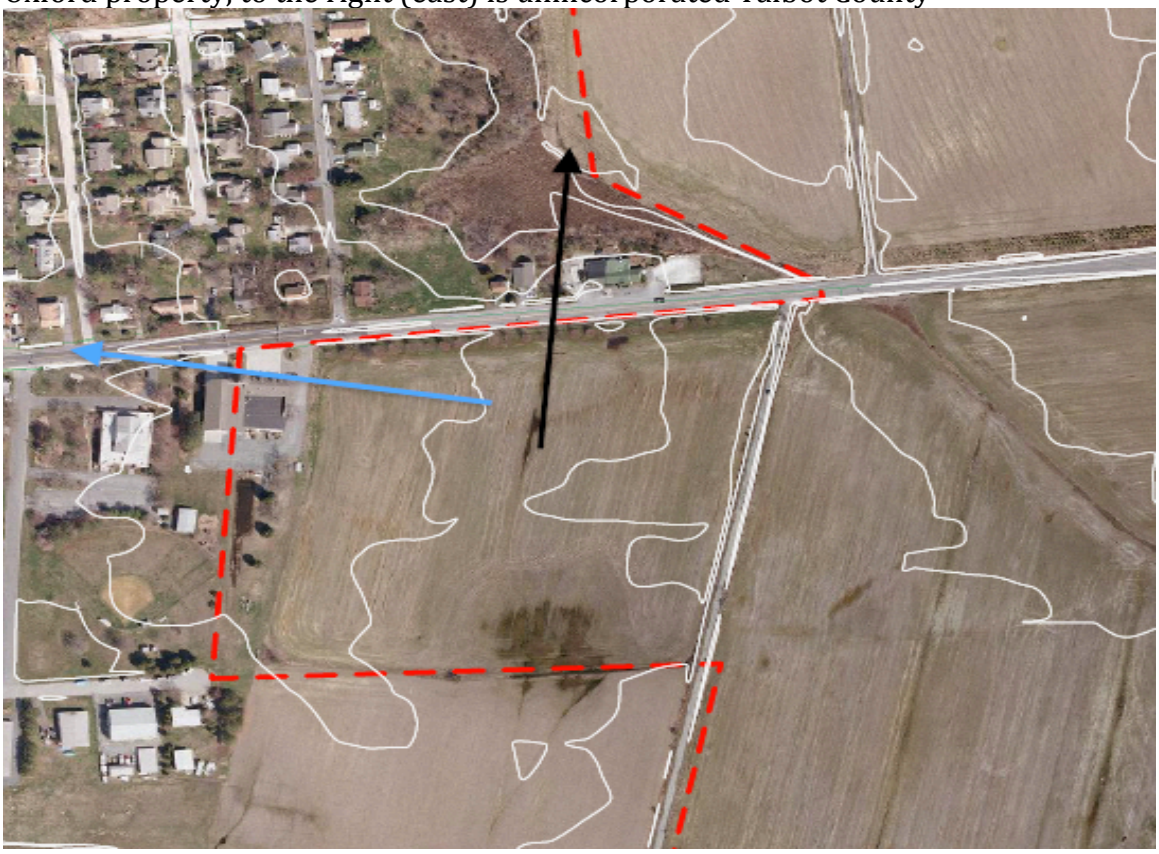
The South Morris Street extended area is essential to understanding the flooding and stormwater runoff patterns in the South Morris Street area. Depending on how property in the extended area is managed, flooding in Oxford and pollution loading in Town Creek can be made better or worse. As described above, the drainage ditch in the agricultural property to the south of Route 333, has filled-in over time and no longer effectively conveys stormwater to Hels Half Acre. Instead stormwater tends to flow west along Route 333 and into the South Morris Street basin (see map 7).

In 2012, 86 acres of unimproved (not-in-use) agricultural property in the South Morris Street extended area to the south of Route 333 was acquired by Talbot County (see map 7). The property is in the State of Maryland's Program Open Space and has passive recreational covenants in place. The land has restrictions that prohibit it be developed for residential use; but trails, unlit ballparks, and similar

[47] Oxford Comprehensive Plan, 2010.

recreational development are allowable uses. In 2016, the Conservation Fund (the previous owner) and Talbot County will select an independent contractor to develop a master plan for the property and ultimately designate land use of this parcel.[48] The property, which has an address on Evergreen Road, serves as a gateway to Oxford and is in close proximity to the town. As such, the town of Oxford intends to be involved with any development decisions on the property and has begun discussions with the County. The ultimate land use designation will affect stormwater loading based on land uses and ditch management.

Map 7. South Morris Street extended former stormwater flow direction (black) and current stormwater flow direction (blue); to the left (west) is of red dotted line is Oxford property, to the right (east) is unincorporated Talbot County



Among the potential engineering solutions capable of mitigating flooding and pollution loading in the South Morris Street area, development on the Evergreen Road property stands out as very promising. Specifically, if stormwater control measures such as a constructed wetland or bioretention pond were installed on the property, less stormwater would enter the South Morris Street drainage basin. There are at least three benefits to such a stormwater control measure. First, a decrease in stormwater loading from the Evergreen Road property would go a long way towards decreased flooding in and around Town Creek. Second, unlike

[48] Talbot County Council Office, June 2012. Official press release of property acquisition.

property in the South Morris Street area of town, there is less conflicted use and the green infrastructure may be more compatible with surrounding landscapes and more easily transformed to absorb and store stormwater. Third, seeing that Talbot County has watershed implementation plan-related nutrient loading reduction goals to meet, the County has an incentive to facilitate stormwater management for the benefit of both the county and the town of Oxford.

Of course, any development on the Evergreen Road property needs to comply with Program Open Space, the recreational covenants in place, and should be in the best interest of the county. Based on conversations with Program Open Space staff, all development should first and foremost be pursued for recreational benefits; stormwater mitigation should be a secondary goal and should not occur at the expense of recreational functionality (see discussion of solutions below).

Case Study: Dewey Beach, DE

Throughout the Mid-Atlantic and Chesapeake Bay region, there are small and large towns attempting to manage stormwater, tidal flooding, and long-term sea level rise. Among the communities grappling with these issues are the Fells Point area of Baltimore, Annapolis, and Norfolk, VA.[49] More comparable to Oxford in size and available resources is the town of Dewey Beach, DE, located between Rehoboth Bay and the Atlantic Ocean. Dewey Beach has a history of severe flooding and has recently begun investing significant funds to develop a stormwater master plan and install stormwater control features in one of its most flood prone areas.

Dewey Beach is smaller than Oxford in terms of full-time population and land acreage, and lies at an equivalent elevation (see Table 5). Both communities have a significant influx of summer visitors and an economy based on tourism and maritime industry. Furthermore, both communities face regular high water events as the result of stormwater, tidal water, high winds, storm surge, or some combination.

Table 5. Oxford, MD and Dewey Beach, DE Comparison[50]

	Oxford, MD	**Dewey Beach, DE**
Population (2010 census)	651	341
Size (in acres)	448	192
Average elevation (ft. above sea level)	7	7

Dewey Beach has recognized stormwater and flooding challenges for years. The town's 2006 Comprehensive Plan states, "flooding as a direct result of low elevation

[49] Kobell, R. January 6, 2012. Sea level along Chesapeake rising faster than efforts to mitigate it. Bay Journal. Available online at: http://www.bayjournal.com/article/sea_level_along_chesapeake_rising_faster_than_efforts_to_mitigate_it.

[50] U.S. Census Bureau, 2010 U.S. Census. Oxford, MD. Available online: https://www.zip-codes.com/city/md-oxford-2010-census.asp.

as well as inadequate stormwater management infrastructure and flood controls creates several problems in Dewey Beach." [51] A trouble spot in town has historically been Bayard Avenue, which terminates at Head of Bay Cove. The local Bayard Avenue basin, about 55 acres in size, would flood at the cove during moderate storm events. Efforts to actively address the issue intensified in part when an emergency situation arose on the street and an ambulance struggled to navigate the high water.[52]

Bayard Avenue Solutions

Around 2010, Dewey Beach initiated an infrastructure committee responsible for identifying, prioritizing, and implementing stormwater improvement projects. Bayard Avenue was the first priority, and through funding from a low interest loan from the Delaware Department of Natural Resources and Environmental Control (DNREC), the town solicited bids for engineered solutions to managing their flooding. After roughly three years of planning, design, and installation, the final project was completed in 2012. Instead of a single fix, the end product is a package of mitigating solutions, including (see Appendix D for photographs):

- Bayard Avenue was raised approximately 7 inches at its lowest point;
- New storm drain pipes of a larger capacity (36") and more durable material were installed;
- Tide gates, or check valves, installed at the outfall pipe to prevent tidal inflow;
- A constructed wetland was installed in the cove, at the terminal of the drainage basin able to filter stormwater and dampen wind and tidal effects;
- A berm was installed between the wetland and a nearby condominium complex, which provided an easement to construct the berm;
- Two stormwater pumps were installed with accompanying new cisterns and out channels for water collection and removal.

The project, overseen by Cotten Engineering, cost $930,000 to complete and involved the cooperation of the local condo association and other neighborhood citizens, Sussex County Conservation District, the Army Corps of Engineers, Delaware Department of Transportation, and DNREC. By all accounts, the system has performed exceedingly well since completion in terms of its ability to mitigate and prevent flooding. During hurricane Sandy, for example, Bayard Avenue was the first street to completely dry.[53] The system's capacity to prevent sediment loading and filter nutrients prior to entry into Rehoboth Bay is also much improved in large part due to the constructed wetland. Financing for the project was supported by the

[51] Dewey Beach Comprehensive Plan, 2006. Available online at: http://www.townofdeweybeach.com/index.cfm?fuseaction=trees.pageDetails&p=260-18-353.
[52] Personal Communications with Gary Hilkert and Rick Judge of Dewey Beach. Phone call on July 23, 2013.
[53] Ibid.

DNREC loan and ultimately paid for with the town's general fund and other accounts.

One minor complaint about the system, and an additional cost consideration, is the failure of the stormwater pumps during power outages. Early in the life of the pumps, they failed a couple times due to power outages and were unable to remove stormwater. The town has since resolved this problem, by contracting with a company to bring in generators in the event of power outages to ensure the pumps continue operating. Generator contractors are very common in smaller localities and often prove to be a more cost-effective option than purchasing a generator and hook up.

In the wake of the Bayard Avenue project, Dewey Beach has since commissioned and completed the development of a Stormwater Master Plan, which breaks the town into basins, identifies existing infrastructure elements, and places a heavy emphasis on nutrient management and best management practices to be installed.[54] With this plan, Dewey Beach has taken an important first step towards remedying pollution and flooding concerns.

Important Financial Context

Oxford's financial context, including the socio-economic makeup of the community, and existing water, sewer, and flood mitigation-related expenditures are a critical consideration prior to developing new stormwater management solutions. To better understand the capacity of a community to finance stormwater improvements, one must have a comprehensive understanding of the composition of both the community and existing infrastructure.

Building Stock, Demographics and Income

The 2011 Maryland Property Viewer tax parcel dataset for Oxford shows a total of 631 parcels, of which 89 percent of the land use is designated as residential properties, and the remaining 11 percent consists of commercial, industrial, and community-owned properties. Approximately half of the single family residential homes in Oxford are listed as owner-occupied implying the remainder are second homes or vacation homes for the town's larger summer population.[55] Although Oxford's maritime industry remains a source of pride and economic activity for the community, the town is primarily residential as measured by both land use and ambiance.

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[54] Cotton Engineering, LLC. 2013. Town of Dewey Beach Stormwater Master Plan for Nutrient Reduction. Available online here: http://www.townofdeweybeach.com/index.cfm?fuseaction=content.pageDetails&id=200311&typeID=24.

[55] MD Department of Taxation and Assessments. Maryland PropertyViewer. 2011 Oxford Parcel dataset.

Compared to other Maryland towns, Oxford is wealthier and older. The 2010 U.S. Census shows the median income for an Oxford household was below the State of Maryland median, and above Talbot County's median at roughly $58,000 per year. The income levels are skewed by the fact that a majority of Oxford's citizens are older with a median age of 60 and more than 30 percent of citizens over the age of 65. Many of Oxford's citizens are retired or approaching retirement age.[56] Although many Oxford citizens are no longer earning an income, there is significant wealth in the community as demonstrated by the median home value in the town assessed at almost double the median value of other Talbot County or Maryland homes.[57]

Not all of Oxford's population is wealthy, however. About 11 percent of Oxford households earned less than $25,000 in income in 2010 and is categorized as very low income, per the Rural Development Agency.[58] In addition, a number of African American families with a long history in Oxford would be considered low income, and have homes on Norton and Stewart Streets, both areas vulnerable to flooding.

Waste Water Treatment Plant (WWTP) Upgrades

Oxford processes sewage at its WWTP, which is owned, operated, and maintained by the town. An enterprise fund covers WWTP related expenses and is sustained by a monthly wastewater utility charge to residents and businesses. The plant was constructed in 1963 and upgraded in 1981. The relatively small WWTP processes 150,000 gallons per day, and serves a peak population of approximately 1,100 during the summer months. The WWTP discharges into Town Creek and is regulated by the U.S. EPA via a national pollution discharge elimination system permit.[59]

Oxford is currently exploring options for upgrading its WWTP to meet ENR requirements in the most cost effective way. Unfortunately for Oxford, the small size of their WWTP and its relative impact on nutrient loading in the Chesapeake Bay means it ranks low compared to larger WWTPs, which are historically the only WWTPs awarded grants under the Chesapeake Bay Restoration fund. Nonetheless, Oxford citizens currently pay into the fund at a rate $5.00 per month per household, which recently doubled from the previous rate.

In 2007, Oxford commissioned a study to evaluate options for upgrading its WWTP in a way that would be consistent with Maryland's ENR requirements. The study found that pumping to the Easton WWTP would have environmental and economic benefits for Oxford, but the Talbot County Council did not approve modifications to

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[56] U.S. Census Bureau, 2010 U.S. Census. Oxford, MD. Available online: https://www.zip-codes.com/city/md-oxford-2010-census.asp.
[57] Oxford Comprehensive Plan, 2010.
[58] U.S. Census Bureau, 2010 U.S. Census. Oxford, MD. Available online: https://www.zip-codes.com/city/md-oxford-2010-census.asp.
[59] Oxford Comprehensive Plan, 2010.

the County's Water and Sewerage Plan, which would be necessary to allow the project.[60] Therefore, the Oxford WWTP upgrades remain unfulfilled and desirable.

Given the limited options and the need to upgrade the plant, the town approved a 3 percent quarterly increase on water rates and a 7 percent quarterly increase on sewer rates in the spring of 2013 to help prepare the town for pending costs. It should be emphasized that despite Oxford's relatively small WWTP, the anticipated costs are substantial. The per-capita costs associated with upgrading Oxford's WWTP will be significant.

National Flood Insurance Program

Oxford participates in the National Flood Insurance Program (NFIP) and has since 1974. Oxford must meet certain federal requirements including requiring new residential and commercial construction to meet flood elevation levels to remain in the program.[61] As a participating community, Oxford's citizens may purchase flood insurance, which offers a financial safety net for damages incurred to property as a result of flooding. Flood insurance only covers the cost of flood damage on the property covered under the policy and is not an appropriate tool for preventing or mitigating flooding that may occur as a result of tidal, storm surge, or rain events. In Oxford, flood insurance is a non-factor in most high water events described earlier as medium-frequency, medium-impact. The most frequently occurring floods are not severe enough to cause damage and therefore warrant a claim.

Flood insurance claims in Oxford are highly correlated with major hurricanes and tropical storms. Hurricane Hazel (1954), Tropical Storm Agnes (1972), Hurricane Fran (1996), and Tropical Storm Isabel (2003) are among the worst recorded flooding events in Oxford. Multiple citizens reported a high volume of flood insurance claims following Isabel (see Appendix A).[62]

In 2011, the Federal Emergency Management Agency (FEMA) developed new flood insurance rate maps (FIRMs) for Oxford, which were subsequently made available to the community for review and appeal, if desired. The 2011 FIRMs are more accurate than the older maps and may have an impact on businesses and homes in Oxford. Most of Oxford was in 100-year floodplain (1% chance of being inundated annually) prior to the new maps and in the 2011 maps, most of the town continues to remain in the same floodplain boundary (see Appendix E).[63]

Oxford's status as a NFIP community suggests most of the businesses and homeowners in town have a flood insurance policy. This policy is a flood

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[60] Oxford Comprehensive Plan, 2010.
[61] Oxford Comprehensive Plan, 2010.
[62] FEMA, 2011. Flood Insurance Study in Talbot County and Incorporated Area. Available online: https://www.rampp-team.com/county_maps/maryland/caroline_coastal/caroline_md_coastal_fis_tables_1.pdf.
[63] Ibid.

management cost that should not be discounted when considering additional costs associated with new stormwater management and flood mitigation engineering projects, and the distribution of project costs across the community. On average, the typical NFIP holder pays $625 per year with the average claim around $30,000. By most accounts, flood insurance is a very good deal for homeowners, businesses, and communities.[64] Most medium-impact. Medium-frequency flood events in Oxford will create little damage eligible for a NFIP claim, but the rare high-impact event makes holding a NFIP policy a solid investment.

[64] Sichelman, L. February 10, 2013. Despite rate increases, flood insurance is worth the cost. Los Angeles Times. Available online: http://articles.latimes.com/2013/feb/10/business/la-fi-lew-20130210.

Chapter 3: Public Outreach

A central component of the work in Oxford was public outreach and engagement on the topic of stormwater. Outreach occurred throughout the duration of the project beginning with neighborhood discussion sessions in the winter of 2013 and culminating with a presentation of findings and recommendations to the community and Oxford commissioners in the fall of 2013. With valuable assistance from the ESLC, the CBF, the Oxford Master Gardner's Club, Oxford officials, and many community volunteers, stormwater and flood management issues were regularly brought to, and discussed with, the Oxford community.

Outreach Objectives and Approach

The objectives of community outreach were to (1) engage Oxford residents and businesses in a dialogue that would allow them to present their concerns and priorities as a means of characterizing the problem and identifying appropriate solutions, and to (2) deliver technical resources and knowledge to the Oxford community allowing them to better understand the range of stormwater management solutions on both public and private property. Regardless of the particular solutions proposed under this project, the aim of the outreach effort was to foster an Oxford community involved in the decision-making process and invested in resolving the flooding and stormwater situations as soon as possible.

The outreach approach focused on the following actions:

- Provide businesses and residents with multiple opportunities to provide feedback including through written comments (e.g., surveys and private emails), via verbal dialogue (e.g., with the commissioners, the project team and their neighbors), and through mapping exercises, and photographs that facilitate problem characterization with visual aides.
- Exhibit a presence and explain the project objectives at town functions including Oxford Day, River Appreciation Week, and a meeting of the Oxford Business Association.
- Instill confidence and self-reliance in Oxford homeowners and businesses concerned about stormwater management on their private property through educational resources (e.g., workshops and written materials).
- Maintain a presence in the community through monthly educational events (e.g., the summer stormwater series), displays around town (e.g., rain barrel, display board in front of the town office), branding (e.g., logo), and regular communications with businesses and residents (e.g., emails and newsletter).
- Encourage community members passionate about stormwater management to become advocates that can regularly engage residents and businesses on the issue, and institutionalize community leadership after the project ends.

Neighborhood Discussions

In December 2012, the outreach campaign was officially launched when the Oxford newsletter introduced the stormwater project to the community and invited residents to the three neighborhood discussions to be held in January and February 2013 to consider the problem (see Appendix G). Earlier conversations within the Oxford Stormwater Task Force identified three geographic areas, or neighborhoods, as having distinct problems requiring tailored solutions (i.e., Jack's Point, the Tilghman Street area or Historic District, and the South Morris Street/Causeway). Recruiting for the meetings entailed phone calls, flyers in the town office and library, and-word of-mouth exchanges.

The three neighborhood discussions were held in the evening at the Oxford town office. The first meeting, covering the Tilghman Street area, saw the greatest attendance of around 35 individuals. The other two meetings each saw about 20 in attendance. Attendees included the Oxford commissioners, the town administrator, project partners, many residents, and representatives from numerous Oxford businesses (e.g., the Oxford Boatyard, Campbell's Boatyard, Benson & Mangold Real Estate).

The meetings, facilitated by staff from the EFC, began with personal and project introductions. The goal of the neighborhood discussions was to gain feedback from the community and there were three mechanisms put in place to achieve this. First, attendees were asked to complete a short 10-question survey that would be used to gauge the magnitude of the stormwater and flood problems in Oxford and attitudes towards resolving it (see Appendix G). Second, a dialogue was initiated when community members were asked to offer up their personal experiences, concerns, and solutions regarding stormwater and flood management in Oxford. Third, attendees were led through a mapping exercise whereby residents were invited to place a dot on a large blow-up map of their neighborhood and annotate a comment associated with that dot on a corresponding sheet of paper (see Appendix F).

The neighborhood discussions were a valuable learning opportunity of the project team and the Oxford community alike. Much of the feedback from these discussions is integrated into the project findings and recommendations. The neighborhood meetings resulted in the revelation from the community that (A) flooding and stormwater are a community-wide problem and the situation as they understand it on their personal property may be unlike their neighbor's across town, and (B) that stormwater and flooding are a recurring and potentially worsening problem that should be addressed immediately (particularly given the resources presently being invested in the town by the NFWF).

Oxford Summer Stormwater Series

To maintain momentum from the winter neighborhood discussions and to bring further resources to the Oxford community, the Oxford Summer Stormwater Series was conceived in March 2013. The Oxford Summer Stormwater Series was comprised of six events, one each month from April to September, designed to keep stormwater management in the public eye, gain additional feedback, and deliver technical information via rain barrel, rain garden, French drain, and green infrastructure workshops.

The Oxford Summer Stormwater Series was advertised by word-of-mouth and through a flyer disseminated via email and in the town office (see Appendix G). The pinnacle event of the series was an information booth at Oxford Day, Oxford's biggest event of the year. Staffed by individuals from the ESLC and the EFC, the booths many engaging features included:

- Annotated maps of Oxford that could be edited by attendees;
- Project informational flyers and information on future stormwater workshops in Oxford via the Summer Stormwater Series;
- Swedish fish candy in a fishbowl that could be "caught" with a fish scooper;
- A live painting of a rain barrel by Oxford artists, which was donated by the Talbot County Master Gardeners and would later be raffled;
- Stormwater surveys, which were the "raffle ticket" for awarding the painted rain barrel; and
- A rain barrel demonstration.

The Oxford Day event saw more than 100 individuals and families visit the stormwater booth. Participation totaled around 10-15 individuals at each of the subsequent events including river appreciation week in Oxford, the rain barrel and rain garden workshop, the French drain workshop, the workshop on stormwater systems (e.g., green infrastructure), and the Bank Street Bioswale volunteer day (see Appendix G).

Presentation of Final Recommendations

The final piece of outreach was presenting the project's findings and recommendations to the Oxford Community. A flyer was put together and residents and businesses were invited to attend one of two evening events held in late September 2013 (see Appendix G). Both nights saw about 20 attendees and included many of the individuals who attended the previously held winter neighborhood discussions. The presentation of findings and recommendations were followed by a discussion among the attendees.

Chapter 4: Program Needs and Capital Improvement Projects

With input from citizens, town officials, and engineers with GMB Associates, the project team assessed the current and future funding needs of Oxford's stormwater program. As outlined above, Oxford does not operate its stormwater program out of a single budget line item. Instead, labor costs associated with maintaining the program come out of general government funds and capital costs often come out of the public works, road department fund.

Pulling out the various elements that constitute a stormwater program, the project team has constructed a five-year stormwater budget (FY 2015-2019) for the town of Oxford including labor, capital, and operation and maintenance costs. Adjusting for inflation at a rate of 2.5 percent per year, Oxford will require approximately $506,000 over the five-year period to complete planned projects and realize substantial stormwater program improvements.

Business as Usual Stormwater Expenditures

Personnel Costs

Personnel costs include the time and effort of the Oxford DPW and the town administrator and town staff. The DPW staff of six men commits approximately 2,300 hours per year towards stormwater management including 75% manpower dedicated towards basic stormwater oversight and on-spot cleaning/repairs, 9% towards twice-annual thorough cleaning, testing and maintenance, and the remainder towards emergency work during high water events and repair emergencies. The town administrator dedicates approximately 15% of her time towards stormwater related work including enforcement of the stormwater ordinance, permitting work under the state's critical areas law, and facilitating stormwater work completed by engineers and DPW. Accounting for inflation, the five-year personnel costs for Oxford's stormwater budget total approximately $260,000. Assuming 20% for fringe benefits, annual labor costs for Oxford are as follows:

- DPW work @ approximately 17,000/year
- General administrative work @ 18,000/year

Capital Improvements

Capital improvements include the scheduled replacement and expansion of Oxford's stormwater infrastructure. Over the FY 2015-2019 period, the town is set to install four tide gates, replace culverts in seven locations, conduct a minor drainage rehabilitation project on Jack's Point, and complete a major new outfall redesign project at Mill Street as part of a comprehensive stormwater program. In addition, the town must purchase equipment including more high water warning signs and a new backhoe to replace the aging existing backhoe (replacement estimated in about

five years at a cost of $80,000). Accounting for all capital improvement projects, equipment purchases and inflation, Oxford will need approximately $260,000 or an average of $52,000 per year. The following schedule of capital improvement projects and costs, which include inflation-driven cost increases at 2.5 percent per year, were assembled from interviews with DPW.

FY 2015

- South Morris Area – Tide gate at Caroline Street @ $10,000
- South Morris Area – Culvert replacement at S. Morris and Pleasant @ $5,000

FY 2016

- Jack's Point – Tide gate at Bonfield and Richardson @ $10,300
- Bachelor's Point – Culvert replacement at Bachelor's Point & Campbell's @ $5,100
- Bachelor's Point – culvert replacement at Bachelor's Point Ct. @ $5,100

FY 2017

- Historic District – Double tide gate, vault, and outfall redesign at Mill St. @ $73,500
- Historic District – Culvert replacement at Wilson and Factory @ $5,300
- Historic District – Culvert replacement at Market St and town office @ $5,300

FY 2018

- Jack's Point –Tide gate and box at Third Street @ $10,800
- Jack's Point – Culvert replacement at Town Creek and Bonfield @ $5,400
- South Morris Area – Culvert replacement at Second St and Pier St. @ $5,400

FY 2019

- Jack's Point – Drainage rehab at Bonfield near outfall at Richardson @ $8,800
- Jack's Point – Drainage rehab on Third St. @ $5,500
- South Morris Area – Drainage rehab at baseball field @ $8,800

Operations and Maintenance

Operation and maintenance expenditures include vehicle maintenance (e.g., fuel and permits) and infrastructure maintenance including tide gate seals. The town is also preparing to improve its infrastructure tracking capabilities through an investment in geographic information system (GIS) training, software, data and compatible hardware. O&M costs total $59,000 over the five-year period at an average of about $12,000 per year.

Total Expenditures and Anticipated Impact

Over the next five years, Oxford is on pace to spend approximately $506,000 to maintain its stormwater program (see Table 6). Roughly half of the expected costs will go towards capital and equipment investments, 40 percent towards labor, and the remainder towards other operations and maintenance expenses.

The total cost associated with maintaining Oxford's stormwater program should not come as a surprise. Over the past few years, Oxford has budgeted roughly $20,000-$40,000 per year for stormwater related capital improvements and the staff time dedicated towards stormwater management. This quantity is on par with historical efforts to fund programs and was reelected in the adopted budget. It should be noted, however, that budgeted stormwater capital investments do not always translate to actual investments. When stormwater costs are financed out of the general fund and there are multiple community projects competing for those limited funds, stormwater projects can become expendable and even postponed. For example, the Caroline Street tide gate project was budgeted in FY 2013, but on-the-ground implementation was deferred as funding was prioritized elsewhere.

Table 6. Business as usual five year stormwater budget for Oxford*

	FY 2015	**FY 2016**	**FY 2017**	**FY 2018**	**FY 2019**
Labor	$35,707	$36,600	$37,515	$38,453	$39,414
Capital and Equipment	$33,900	$38,950	$102,961**	$40,922	$43,049
O&M	$19,310	$9,543	$9,781	$10,026	$10,276
Total	**$88,917**	**$85,093**	**$150,257**	**$89,400**	**$92,739**

* Assembled by EFC with input from town of Oxford and GMB Associates; ** Includes Mill Street outfall redesign and tide gates.

The current spending scenario focuses on much needed infrastructure repairs that will have a noticeable impact. For example, the Caroline Street tide gate project investment will prevent tidal inflow and take pressure off the much troubled Causeway area. The $73,500 Mill Street project is another example of a necessary investment that aligns directly with the problems outlined in Chapter 2 and whose mitigation meets the feedback from Oxford residents.

Nonetheless, through consultations with engineers at GMB Associates and DPW superintendent, the overall consensus is that the existing schedule of capital improvements will marginally improve Oxford's serious stormwater issues. Even with the investments outlined above, medium-impact and medium-frequency high water events would likely be as impactful and frequent as they are now, if not more so. To be sure, stormwater infrastructure is, for the most part, not designed to mitigate flooding from tidal and storm surge events. But there is an expectation that Oxford's stormwater system should, at a minimum, not exacerbate the tidal flooding issues (e.g., help from tide gates), and the system should facilitate with dewatering during all high water events. The currently scheduled improvements will keep the town's stormwater system out of disrepair, but will not advance the system to a place where the high water problem drastically improves. Moreover, the town expects the list of necessary repairs to grow in the coming years – this will be achieved with assistance from the new scoping camera, which will increasingly be deployed to evaluate the stormwater system. Finally, in terms of pollution control, there is limited knowledge about the impact the planned repairs will have on nutrient loading. In turn, the town should consider additional investments more

capable of mitigating the severity and frequency of high water events as well as reducing pollution loading.

Supplemental Management, Engineering Solutions and Costs

A variety of managerial and engineered solutions are available to Oxford, which are capable of addressing the specific issues outlined in Chapter 2 and ultimately making a significant impact on Oxford's high water situation. Stemming from citizen feedback and discussions with the town's engineer and DPW, as well as lessons learned from Dewey Beach, the discussion below outlines a few promising solutions as options for the town to consider. The discussion of projects and cost estimates that follows is limited because the detailed engineering work necessary to accurately evaluate projects was outside the scope of this study. Nonetheless, the options shed some light on very promising technical solutions to flood mitigation and stormwater pollution and going beyond meeting current issues, but actually advancing the issue. It should also be noted, that based on citizen feedback, all projects should emphasize a primary need to address high water concerns in the Causeway/South Morris Street area, followed by the Historic District (i.e., Mill St, Tilghman St, Bank St), as these areas are key trouble spots and therefore targeted for engineered solutions.

General Management Solutions

There are management actions Oxford can take to improve the performance of its entire stormwater program. These are not location-specific engineering solutions, but general measures applied across the town. Although these actions may not result in direct changes in Oxford stormwater patterns, they are cost effective measures that will lower the burden on the technical and engineering side and position Oxford for long-term success in stormwater management.

Stormwater Infrastructure Database, Map and Master Plan – While this project has shed light on Oxford's stormwater system, it has also revealed how much remains to be learned. Oxford is lacking a complete picture of its stormwater infrastructure including the location, age, and condition of all components. Larger communities with more resources and greater stormwater responsibilities typically maintain a database that catalogues system information, prioritizes repair and replacement schedules from it, and links it geographically so the system can be visualized and therefore better understood. In turn, a comprehensive system database and map can be used to develop a detailed stormwater master plan, which sets the schedule for all short and long term capital improvement projects, their costs and expected impacts. A stormwater master plan would also have the advantage of focusing on nutrient loading in Oxford and best management practices for nutrient loading reductions. A stormwater master plan would be developed by an engineer and therefore more technically robust than the current report.

- **Cost**: In 2013, Dewey Beach completed a stormwater master plan at a cost of roughly $50,000. Among other tasks, Cotton Engineering, LLC, the firm on

contract, collected light detecting and remote sensing (LiDAR) data through surveys, developed precise watershed and sub-watershed patterns, and selected best management practices to minimize pollution loading into Rehoboth Bay.[65] Recognizing that Oxford is larger than Dewey Beach and may desire additional LiDAR mapping and data collection services, the total one-time cost of an infrastructure database, map, and stormwater master plan, developed by an engineering firm, is estimated at $98,000. The results would yield great dividends in better understanding drainage patterns of surface and ditched overland flow, as well as where to place future BMPs.

Education and Outreach Initiative – Education and outreach efforts allow community members to better understand how their decisions impact stormwater in Oxford. By understanding the role of bioswales, for example, community members see them not as mosquito breeding grounds that should be mowed, but as a valuable piece of stormwater infrastructure that helps to mitigate high water events. There is also the fact that most of the property in Oxford is privately owned. Collectively, Oxford's private businesses and residents can have a significant impact on pollution and flooding.

One topic area that would be an excellent candidate for increased education and outreach is building and property modifications for new and existing homeowners. As witnessed at the neighborhood discussion meetings, there is some uncertainty regarding what Oxford residents (and their neighbors) can and cannot do to their property to address stormwater flooding and pollution concerns. Some Oxford residents appear to be unsure about how the Maryland Critical Areas Law and the Oxford Stormwater Ordinance applies to their property management decisions. Translating these laws into a simple one-page document and making it available to all Oxford residents, and in particular new residents, would help prevent some confusion and lead to better stormwater management decisions on private property.

Feedback from the neighborhood discussions and turnout for the Oxford Summer Stormwater Series indicates community members are eager to do what they can on their own property. Community members simply need access to knowledge and resources that enables them to take control. The town has knowledgeable and trusted residents willing to volunteer their time as well as valuable partnerships with outside entities like the Talbot County Master Gardeners, University of Maryland Sea Grant, and the ESLC. If Oxford continues to foster the partnerships on display over the past year, the town does not need to spend a great deal of money to perform effective outreach and education.

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[65] Cotten Engineering, 2013. Town of Dewey Beach Stormwater Master Plan for Nutrient Reduction. Available at: http://www.townofdeweybeach.com/index.cfm?fuseaction=content.pageDetails&id=200311&typeID=24.

- **Cost:** With a minimal contribution of town staff time and some material resources (i.e., see Chapter 2), Oxford can become a conduit between knowledgeable volunteers and the community. Oxford could spend $1,200 annually on materials (e.g., an annual stormwater newsletter) and door prizes for events (e.g., rain barrels, plants for a rain garden). Additionally, an Oxford staff person could dedicate 3 percent of their time to organizing and recruiting for educational events for about $3,000 annually. The total cost of an effective education and outreach initiative is estimated at $5,000 annually.

Local Ordinances and Other Soft Measures – Another action the town of Oxford could take is to reassess and modify existing zoning laws, building codes, and ordinances to maximize stormwater and flood management benefits. For example, setbacks, buffers, and easements might all be used to decrease the frequency and severity of high water events and help the community prepare for anticipated sea level rise.[66] In Jack's Point, the separation that exists between tidal marshes and neighborhood homes is an important factor as to why high water events are not as severe or frequent as they might otherwise be. The zoning, or specifically, the absence of development in these marshy areas, allows for a natural flood buffer. This study minimally examined Oxford's zoning, building codes, and ordinances and is not in a position to recommend specific changes. Nonetheless, local policy changes, including zoning in particular, may be an effective stormwater management tool.

South Morris Area Constructed Wetland

A wetland is an ecosystem with multiple functions including holding water and absorbing and filtering pollutants before slowly releasing water to downstream ecosystems. Wetlands, marshes, swales, and similar entities exist throughout Oxford and the Chesapeake Bay region and all provide similar ecosystem services. Wetlands can be both natural and manmade (i.e., constructed wetlands). Constructed wetlands can be designed to mimic natural wetland functions and can serve multiple purposes including wastewater treatment, stormwater runoff storage and treatment, wildlife habitat, protection against storms and storm surge, and recreation.[67]

The idea of creating additional water storage and absorption capacity through a constructed wetland or similar technology has been discussed for some years in Oxford. In 2010 and 2011, for example, the town submitted an unsuccessful grant proposal to the NFWF for funds to construct a wetland in the South Morris Street/ South Morris extended area of town. A constructed wetland in this location is more

[66] Grannis, J. 2011. Adaptation Toolkit: Sea Level Rise and Coastal Land Use. Georgetown Climate Center. Available online: http://www.georgetownclimate.org/sites/default/files/Adaptation_Tool_Kit_SLR.pdf.
[67] U.S. EPA, Constructed Wetlands. Available online: http://water.epa.gov/type/wetlands/restore/cwetlands.cfm.

feasible than in the Historic District because there is available space and a South Morris wetland would have greater benefits given the limited water storage capacity relative to the size of the drainage basin.[68] While a constructed wetland wouldn't necessarily address tidal or storm surge flooding, it would be instrumental in decreasing the amount of stormwater from points south and east of Town Creek, which tend to bottleneck at the Causeway. Such a constructed wetland would also reduce pollution by collecting and filtering stormwater runoff before reaching the Chesapeake Bay.

The precise location and design of a constructed wetland is up for discussion. In the 2010 NFWF proposal, the town offered 25 acres of available land entirely within the town boundaries including the areas to the south and east of the Causeway Park. In 2011, the town added 25 acres for a total of 50 acres, through a proposed donation from the Conservation Fund property in unincorporated Talbot County. This additional 25 acres of property, also known as the Evergreen Road property discussed in Chapter 2, belongs to Talbot County as of 2012 and is in Maryland's Program Open Space.

Based on several factors, county-owned property located on Evergreen Road, to the east of Oxford, appears to be a prime location for siting a constructed wetland. First, this area along State Route 333 is believed to be contributing significantly to stormwater runoff into Town Creek at the Causeway. Second, there is ample space and fewer conflicted uses than land in the town of Oxford. Of course, the Program Open Space recreational covenant presents restrictions (discussed below), which would need to be adhered to. Third, Talbot County has WIP and TMDL objectives of its own, which could be advanced substantially through a constructed wetland. In turn, both Oxford and Talbot County have a vested interest in the project allowing for cost sharing opportunities and a decreased burden on both parties. Last, within three years of the property transfer, a master plan for the property must be developed for passive recreation on the land.[69] Near-term decisions about the fate of the land suggest now is the time to evaluate a major constructed wetland project.

There is no presumption by the town of Oxford that it can unilaterally complete a constructed wetland project on county-owned, Program Open Space land. Clearly the town must abide by the passive recreation covenants on the land as well as defer to Talbot County and their preferences. Nonetheless, at this stage it should be emphasized that the project team including the engineers at GMB Associates and the EFC believe a partnership with Talbot County and Program Open Space would be very promising for stormwater management. If agreeable, a constructed wetland on the Evergreen Road property could present multiple benefits including stormwater management, pollution reduction, flood control, and recreation, and afford a great opportunity for all parties.

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[68] Personal communication with Steve Marsh, GMB. Telephone call on July 13, 2013.
[69] Talbot County Council Office, June 2012. Official press release of property acquisition.

Other areas where water storage and filtration capacity might be located include the Causeway Park, the perimeter of the park, the area adjacent to WWTP where the community garden plots are located, or the baseball field. The willingness of the community to part with the functionality of any of these properties, as well as the suitability of the sites to actually host stormwater storage capacity is yet to be addressed by Oxford residents and engineers, respectively.

- **Cost**: Setting aside the question of project siting and the potential for cost sharing for the moment, the project team considered the costs associated with two constructed wetland designs: a 5 acre and 17 acre wetland. The 17 acre wetland would be about 2.8 times the total cost of the 5 acre wetland and more effective at capturing stormwater and reducing pollution loading, but not necessary 3 times as effective. The precise impact each project would have on stormwater and nutrient loading would need to be evaluated through further engineering studies (see Table 7).

Table 7. Costs for a 5 and 17 acre constructed wetland in Oxford*

	5-acre wetland	**17-acre wetland**
Outfall structure	$5,000	$5,000
18-inch diameter RCP	$10,000	$10,000
Excavation	$193,600	$658,240
Erosion and sediment control	$20,000	$30,000
Fine grading	$3,630	$9,680
Hydroseeding stabilization	$3,267	$8,712
Planting	$3,267	$111,078
Environmental specialist	$12,500	$12,500
Surveying	$5,000	$5,000
Design and permitting	$40,000	$50,000
Sub-costs	$296,264	$900,210
Contingency costs	$74,066	$135,031
Maintenance costs**	$38,932	$94,636
Total cost	**$409,262**	**$1,129,877**

* Costs assembled by GMB Associates; **Assumes 5-years of maintenance costs set at 2 percent of the capital costs per year and adjusted for inflation at 2.5 percent per year; average lifetime of constructed wetland 30+ years.

South Morris Road Elevation and Stormwater Pump

A constructed wetland in the South Morris area of Oxford would decrease the amount of standing water at the Causeway resulting from precipitation and snowmelt. However, a wetland would do little to mitigate the effects of tidal and storm surge flooding occurring at the Causeway, particularly in the roadway. In turn, to truly reduce the severity and frequency of high water events at the Causeway, and the frequently noted concern about water on State Route 333, it would be necessary to couple technologies and address different drivers of flooding.

To address the problem of tidal water overtaking State Route 333 and leading to standing water on the road, GMB Associates evaluated the idea of elevating the road. The topography shows that State Route 333 lies at about three feet above mean high water for a stretch of roughly 650 linear feet as it rounds the Causeway at Town Creek. By elevating this stretch of 650 linear feet by one foot, most of State Route 333 at the Causeway would be four feet above mean high water and thus removed from frequent flooding. A one-foot road elevation would effectively connect two higher elevation points and bolster the most vulnerable portion of the Causeway, resulting in fewer impacts to daily traffic patterns and facilitating emergency egress during high water.

The road elevation project would achieve two goals. First, by elevating the road, tidal and storm surge water would be less likely to inundate the road and create a driving hazard. This addresses a primary concern for Oxford residents. Secondly, the curb of the road would be designed in such a way to provide additional protection against tidal inundation and the addition of water to the area behind the Causeway at South Morris Street and the area where Lake Oxford forms.

Nonetheless, the elevated road could create additional high water problems for South Morris Street at the site of Lake Oxford. Namely, stormwater collecting at Lake Oxford would need to overcome a greater elevation change to find its way into Town Creek. As a component of the road elevation project, the Causeway outfalls under State Route 333 would be redesigned so that the intake at the south of State Route 333 could still receive water and effectively dewater Lake Oxford. But the effectiveness of the Causeway outfall is limited when the tide is high and there is backpressure on the outfall.

To address this concern, GMB Associates evaluated the construction of stormwater pumps in the South Morris area capable of overcoming the elevation change and dewatering Lake Oxford. The pumps would remove tidal water that overtakes the road, but more importantly, would remove stormwater. In the event of significant precipitation and the formation of Lake Oxford, the pumps would quickly dewater the South Morris area allowing for vehicles to pass on South Morris Street. There are at least two locations for discharging the stormwater pumps to help dewater this area. One option would be to simply pump the water directly into Town Creek. While this option offers the simplest and least expense, it would be pointless to discharge water into Town Creek during a high tide or storm surge event where State Route 333 is compromised and any additional water in Town Creek only finds its way back on shore. In the event of tidal or storm surge flooding, the pump would only be used to dewater the area after the tide has receded. The second option would be to discharge the stormwater through pumps to a newly constructed wetland. While the additional energy and infrastructure needed to move the water away from the Causeway would likely increase the costs, this would be a much more effective option. By moving both stormwater and, potentially tidal water to a constructed wetland, there are nutrient reduction benefits that pumping directly into Town Creek does not afford. Moreover, if the stormwater pumps are

discharging into an upland wetland, then they can run throughout a tidal or storm surge event. Compared to discharging directly into Town Creek, discharging the pumps into an upland wetland allows the town of Oxford to gain nutrient reduction benefits and ensure the pumps can run even when the Causeway is overtaken by tidal water.

The combined projects of elevating State Route 333 and constructing a stormwater pump will drastically and beneficially impact the frequency and severity of flooding in the South Morris Street area. These projects will be even more effective if coupled with a constructed wetland that serves to limit the amount of stormwater accumulating at the Town Creek bottleneck, and potentially, receives excess tidal and stormwater from the Causeway pumps. The timing and prioritization of these projects is discussed more below. Regarding the road elevation, it should be noted that this would require cooperation with the Maryland State Highway Administration, and possibly other permitting agencies. Likewise, there may be grant or loan opportunities from the State to complete the road elevation work.

- **Cost** –Table 8 outlines estimated costs and design specifications for both the road elevation and stormwater pump projects. We assume both the dual stormwater pumps and road elevation projects occur in tandem, but recognize further engineering studies should be completed to evaluate how these projects would interact. The costs below assume dual stormwater pumps draining an area the size of 30 acres. Furthermore, the costs assume the stormwater pumps discharge into Town Creek and that the pumps are installed with backup power generation (costs included). The road elevation project includes the costs of a built-up curb able to provide additional tidal mitigation benefits.[70]

Table 8. South Morris Street Projects and Costs*

Project Name	Estimated Cost**	Specifications and Details
Dual Stormwater Pumps at Causeway	$500,000 + $2,000/yr for O&M	Two variable pumps servicing a drainage basin about ~30 acres in size; 20/80 percent breakout between labor and equipment costs
Road Elevation	$338,000	Elevate the Causeway (State Rt. 333) by 1 foot for 650 linear feet
Total Costs	**$848,500**	

* Costs assembled by GMB Associates; ** Accounts for initial project cost plus 5-years of operation and maintenance at 2.5 percent per year; lifetime of stormwater pump would be greater than 20 years

[70] Personal communication with Steve Marsh, GMB. Email on September 6, 2013.

Historic District Shoreline Protection and Stormwater Pump

Three engineering projects aimed at reducing the frequency and severity of flooding in the Historic District were evaluated as a part of this study.

- First, the Mill Street outfall will be redesigned and an improved tide gate will be installed. Included above in the business-as-usual budget, the Mill Street outfall redesign is a priority project for the town of Oxford and is slated to occur in the next five years at a cost of approximately $70,000.
- The second project evaluated is shoreline protection along portions of Tilghman Street and Bank Street. Due to limited height and absent shoreline buffers in this section of the Historic District, tidal and storm surge driven flooding is a more prominent issue.
- The third project evaluated is stormwater pumps similar to those proposed for the South Morris Street area.

The final two projects are not currently part of Oxford's five-year stormwater budget, but are presented as potential solutions in the following paragraphs.

Constructing and expanding shoreline structures is not an uncomplicated process. First, most of the existing shoreline structures in Oxford are privately owned, maintained, and financed; however, the performance of these structures (i.e., their ability to repel tidal and storm events) often extends beyond private property and impacts the surrounding neighborhood, for better and/or for worse. Any investment in private shoreline protection begs the difficult question: who should pay and who benefits? Given that shoreline protection is a "public good" in a low-lying, densely populated town such as Oxford, there is just cause to ask the public to assist with the cost of private shoreline projects, provided the most publically-beneficial projects are given priority.

In addition to the land ownership issue, there are important environmental and engineering factors associated with shoreline structures. Bulkheads and other hard structures are discouraged by the Maryland Department of the Environment and are seldom permitted because they expedite erosion, harm intertidal habitat, and require frequent maintenance. Bulkheads also serve to trap stormwater inland and can disturb natural drainage channels. Installing bulkheads and other hard structures can result in a chain reaction of investment needs and ultimately, what is originally designed as a bulkhead to keep tidal water out, may soon need to be modified to serve as an outfall for stormwater. Moreover, building of bulkheads can quickly become an 'arms race' as water always seeks the path of least resistance. Constructing a berm or other hard structure along the Causeway could simply push tidal water downstream and onto other Oxford properties. While some hardened grey infrastructure improvements offer excellent stormwater management benefits, bulkheads do not fall under this category. As technology is continually improving, it is often a combination of grey and green (softer, living) structural improvements

that together offer the greatest stormwater runoff reductions and lowest management costs.

In turn, comprehensive engineering studies and community feedback should be central to the design, location, and costs associated with any shoreline protection project in the Historic District or elsewhere in Oxford. The most likely technology to be installed would be a living shoreline, wall, or similar soft structure, which has the advantage of filtering stormwater, providing habitat, and facilitating shoreline accretion (as opposed to erosion).[71] The precise location of a shoreline protection structure such as a living wall would need to be determined by further engineering studies.

A properly designed and maintained shoreline buffer will help to minimize tidal and storm surge inundation, particularly along Tilghman and Bank Streets. However, increased shoreline buffers will not assist with the removal of stormwater, which collects at low points on Bank Street, Tilghman Street, and Mill Street. A stormwater pump, however, would expedite the removal of stormwater that collects in Historic District basins. As noted above, if the tidal water is too high there is significant backpressure placed on the outfalls and stormwater does not discharge. A pump would overcome this barrier and serve to dewater standing stormwater.

Approximately 11 acres of land drain to Mill Street, including the area south of the Strand and east of Oxford Road, making it the largest collection basin in the Historic District. In turn, Mill Street is a natural candidate for stormwater pumps. To dewater portions of Tilghman and Bank Streets, additional pumps may need to be installed in these particular locations. Further engineering studies would be needed to optimize the siting of stormwater pumps in the Historic District. Similar to the South Morris Street pumps described above, the question of where to discharge the pumped water and locate the pumps is an important one. With the construction of the new tide gate and outfall redesign at Mill Street, most tidal events should contribute very little water, if the tide gate is functioning properly and not allowing tidal inflow. If bulkhead and shoreline structures around Mill Street are overtaken by tidal or storm surge events, then flooding would occur. Without tidal influence, the biggest high water threat to Mill Street would be from stormwater. In turn, pumps at Mill Street discharging into Town Creek would be effective at removing stormwater without the risk of later allowing tidal water to come ashore.

- **Cost**: The estimated costs of shoreline protection along Tilghman and Bank Street and stormwater pumps at Mill Street are presented in table 9. The shoreline protection project assumes 300 feet of shoreline will be secured at a cost of $350 per foot. The exact number of feet, type of shoreline structure, and location of shoreline protection would need to be identified through further engineering studies. The stormwater pump costs assume dual pumps

[71] Chesapeake Bay Foundation, 2007. Living shorelines for the Chesapeake Bay watershed. Available at: http://www.cbf.org/Document.Doc?id=60.

covering an area the size of around 11 acres. Furthermore, the costs assume the stormwater pumps discharge into Town Creek near Mill Street and that the pumps are installed with backup power generation (costs included).

Table 9. Historic District Stormwater Projects and Costs*

Project Name	Estimated Cost**	Specifications and Details
Dual Stormwater Pumps at Mill Street	$300,000 + $2,000/yr for O&M	Two variable pumps servicing a drainage basin about ~11 acres in size; 20/80 percent breakout between labor and equipment costs
Shoreline Protection at Tilghman/Bank Street	$110,300 including 5% contingency cost	Assumes the construction berm or living shoreline for 300 linear feet at $350 per foot
Total Costs	**$420,800**	

* Costs assembled by GMB Associates; ** Accounts for initial project cost plus 5-years of operation and maintenance at 2.5 percent per year; lifetime of stormwater pump would be greater than 20 years

Summary and Analysis of Stormwater Program Budget Scenarios

The solutions outlined above present a menu of options for the town of Oxford to consider. Solutions can be selected a la carte to meet the most pressing needs and achieve Oxford's stormwater program goals. Like other major investments, the town's stormwater program can resemble a thrifty, low-cost, low-impact model or a luxury, high-cost, high-impact. The ideal stormwater budget is in the middle of these extremes, achieving the most outcome at the least cost. Ultimately, the stormwater program budget adopted by the town will reflect upon Oxford residents, meet their expectations for stormwater management, and their willingness to pay for a given level of service.

Stormwater Program Budget Options

Looking at the business-as-usual-budget including planned capital improvement projects as well as supplemental engineering and management solutions, a range of five-year budgets can be assembled and compared. Table 10 shows five budget options for Oxford varying from option 1, a low-cost, business-as-usual budget, to option 4, a high-cost, all-options-on-the-table budget. Options 2, 3a, 3b, and 4 are additive to option 1 with each subsequent option incorporating some additional management or capital improvement investment. Option 2 presents a $630,000 five-year budget that includes all currently planned stormwater capital improvement projects plus funds for education and outreach ($5,000/year) and a stormwater map, inventory, and master plan ($98,000). Options 3a and 3b include everything option 2 includes plus one additional major capital improvement project. Options 3a and 3b differ in which capital improvement project is pursued; option 3a includes a 5-acre constructed wetland ($409,000) while option 3b includes the combined road elevation and stormwater pump project ($848,000). Both options 3a

and 3b are presented because there are some practical differences regarding the timing, impact, and feasibility of both projects (discussed below). Option 4 assumes all projects presented in this study are completed, which would result in the greatest reduction in the frequency and severity of high water events at a significant cost. It should be noted that no level of spending can guarantee tidal and stormwater flooding does not occur in Oxford.

Table 10. Five-year Stormwater Program Budget Options (highlighted rows referenced below)

Budget Number and Name	Description	5-Year Cost	Impact on Flooding and Pollution
1: Business as Usual Program (Basic)	Includes all currently scheduled repairs and construction including new tide gates at Caroline and Richardson, Mill St. project, and culverts. Maintains status quo.	$506 K	**Least Impact –** Addresses current system repairs, but does not position Oxford for long-term improvement.
2: Basic + mapping + planning + education & outreach	Includes all currently scheduled projects, and development of infrastructure map and master plan, plus some funds for ongoing education and outreach.	$630 K	Small direct beneficial impacts, and planning will position Oxford for long-term success.
3a: Basic + mapping + planning + education/outreach + constructed wetland	Includes all currently scheduled projects, master plan, plus installation of a 5-acre constructed wetland in the South Morris area – location to be determined.	$1.0 M	Marginal reduction on formation of Lake Oxford and TMDL removal benefits.
3b: Basic + mapping + planning + education and outreach + Causeway road elevation + pumps	Includes all currently scheduled projects, plus master plan, plus major capital improvement projects at the Causeway (Pumps and road elevation).	$1.5 M	Greater direct impact on Causeway flooding and decreased formation of Lake Oxford. Improved TMDL benefits.
4: All options including wetland and investment in shoreline buffers	Includes constructing a 5-acre wetland, installing storm pumps at Causeway and Mill St., expanding coastal buffer, plus all existing projects and a master plan.	$2.3 M	**Greatest Impact** – Capital projects have significant direct beneficial impacts, all above, but there are no guarantees (i.e., hurricanes).

Prioritizing Projects and Timing

Missing from the above discussion of stormwater budgets are questions of timing and priority. What projects should be implemented when, and what is the support for each particular project? Drawing from interviews with GMB Associates, Oxford DPW, and feedback from citizens, the following section addresses these questions and recommends a five-year stormwater budget for the town.

First, regarding the stormwater map, inventory, and master plan, this is a low-cost investment that will pay dividends for years to come. Oxford should build more technical knowledge as a precursor to launching into more expensive endeavors. Likewise, education and outreach is a simple, inexpensive step Oxford can take to better position its residents to take control of stormwater management on their property, as well as a collective whole for the community.

Second, it should be restated that a majority of citizens listed State Route 333 or South Morris Street as their primary area of concern in the 2013 Oxford stormwater survey. Oxford residents are uneasy about high water on the roadways and the anxiety associated with leaving town during high water events. [72] In turn, additional capital improvement projects addressing the South Morris Street area are prioritized in the presentation of budget options (i.e., projects 3a and 3b). Also, recognize the Mill Street outfall redesign and tide gate project is a currently scheduled project that will address a priority concern in the Historic District. The South Morris Street area requires immediate attention as the main entry and exit point to town and a sensitive location frequently exposed to flooding.

There are important differences to consider when selecting between the two major project ideas for the South Morris Street area (i.e., constructed wetland or road elevation combined with stormwater pumps). If the town ops to handle stormwater with a BMP using the constructed wetland, it offers stormwater storage capacity as well as stormwater filtration and associated environmental benefits, all at a lower cost than the road elevation/pump project. Nonetheless, a constructed wetland would only marginally reduce the amount of stormwater collecting at Town Creek, which leads to the formation of Lake Oxford. Namely, a constructed wetland east of Oxford on the Evergreen Road property would be at the outer edge of the drainage basin and would only address a small portion of the stormwater loading.[73] Not only is the expected impact of the constructed wetland minimal, there are also practical considerations to completing the project. Within the town of Oxford there are space constraints and conflicted use considerations; outside of Oxford, at the Evergreen Road property, the decision is not the town's to make, and must try and influence the project from the outside.

From both a feasibility and impact standpoint, a constructed wetland project has major shortcomings. This is not to say a constructed wetland project should not be explored. With the potential to share benefits (nutrient reduction and flood mitigation) and costs with Talbot County, a constructed wetland on the Evergreen Road property is very promising. At the moment, however, the constructed wetland concept should be monitored, but not prioritized by the town of Oxford.
In the interim, Oxford should explore the possibility of constructing a wetland in the town limits and the impact it would have on high water events and nutrient reduction (e.g., as part of a stormwater master plan). Moreover, Oxford should continue to communicate with Program Open Space and Talbot County regarding decisions about the Evergreen Road property. One of the simplest steps that can be taken by the County and other involved parties would be to clear out the drainage ditch on the Evergreen Road property and adjacent properties to ensure as much stormwater as possible is being channeled across Hels Half Acre and not running west along State Route 333 and accumulating at the Causeway-Town Creek

[72] Oxford stormwater survey, 2013.
[73] Personal communication with Steve Marsh, GMB. Telephone call on September 17, 2013.

bottleneck.[74] After all, if a constructed wetland were to be constructed on the Evergreen Road property, an outfall channel would need to be put in place to connect the wetland to either Town Creek or Boone Creek.

An alternative to constructed wetlands for managing high water is the road elevation combined with the stormwater pump project. The combined project is more expensive (approximately $.5 million more) than a constructed wetland, and doesn't have the same nutrient management benefits. However, it shows real promise for directly and immediately addressing the largest stormwater problem facing Oxford: high water on State Route 333 and the formation of Lake Oxford. In terms of substantially addressing the key concerns head on, this option offers direct improvements. Feasibility of implementation for this option is also less of a concern, compared to a constructed wetland, since the property hosting the BMPs is located entirely within town. Additional considerations include a potential traffic detour on a major thoroughfare and acquiring consent from the State Highway Administration to complete the project. In terms of cost, the road elevation portion of the project could be offset with FEMA or State Highway Administration funding as it resolves a major emergency evacuation and road safety issue. As a result, the road elevation and stormwater pumps should be the next major capital improvement prioritized by the town of Oxford (after the currently scheduled projects).

The timing of these projects over the next five-years is an additional factor. To get Oxford off on the right foot, we recommend the stormwater map, inventory, and master plan, which we propose budgeting for completion in fiscal year 2015. Next, given the significant costs associated with the planned Mill Street outfall redesign project in fiscal year 2017, we recommend completing the road elevation and stormwater pump project on South Morris Street no earlier than fiscal year 2018. It should be noted that the completion of all projects is contingent upon funding availability, which is liable to shift project timelines. A detailed stormwater program budget recommendation and justification are presented in Chapter 7 to implement such recommendations, but first the realities of financing program costs are addressed in Chapter 5 and 6.

[74] Ibid.

Chapter 5: Financing Options

There are a number of options for covering the costs associated with Oxford's stormwater program. The stormwater program has historically been financed by grants and the town's general fund. Throughout Maryland and the Mid-Atlantic region, there is a movement towards dedicated stormwater funding through the creation of a utility fee. There are also the options of bond financing and blended funding. The discussion that follows looks at these different funding options and reviews their advantages and disadvantages.

General Funding

The Oxford Commissioners and Administrator work together to annually develop a budget that will allocate general funds towards maintaining, and hopefully improving, the town's many services. The town is not alone in relying on general funding to cover stormwater program expenses – it remains the dominant form of stormwater financing for most Maryland municipalities. Nonetheless, with the possibility of annual stormwater program expenditures in excess of $1 million, the general fund is not a sustainable source of funding. Nor should the town finance stormwater at the detriment of other community services.

For the FY 2013 budget, Oxford anticipated approximately $1.07 million in general fund revenue from property taxes, intergovernmental contributions, licenses, fees, and other sources. At the end of FY 2012, the town's general fund had a balance of approximately $1.62 million. Oxford is in good financial standing as indicated by the sizeable general fund surplus and, therefore, could allocate a greater amount of funds towards stormwater than it has in the past. This could be a feasible short-term solution, but over time, it would likely place strain on the general fund balance. It should also be noted that the town holds a position of maintaining a large general fund balance in case of emergencies, in-part because the town's higher than average wealth status limits its access to certain forms of emergency funding.

In summary, general fund based stormwater financing can be susceptible to shifting community priorities, changing commissioners or political landscape, or emergency situations. General fund financing is unlikely to be a stable source of long-term financing for the town's stormwater program, particularly if Oxford elects to ramp-up its program with capital improvements and potentially invest more than $1.5-3 million over the course of a five-year period. Blended funding, discussed below, could be a more sustainable, reliable, lower-risk use of the town's general fund in a stormwater program context.

Grants

Grants have been used in the past to support Oxford's stormwater program including assistance from the Maryland Department of Natural Resources and the

NFWF. To the extent Oxford continues to show leadership and innovation in managing stormwater, the town's stormwater program will be an attractive use of grant funding for sponsors.

However, grants are neither reliable nor sufficient enough to cover the pending costs of Oxford's comprehensive stormwater program. Competition for grant funding is always high and availability is contingent upon broader economic and political trends outside of the town's control. Oxford should not rely solely on grants to cover the expenses of its stormwater program. That being said, the following grant programs represent a short list of opportunities Oxford might consider pursuing to help defray costs:

- **National Flood Insurance Program, Community Rating System** – A program that rewards communities for going beyond the minimum national flood insurance program requirements. Rewards do not include grant funding per se; instead, rewards include discounts on flood insurance premiums for the community's policyholders. As of 2011, there were 8 CRS-designated communities in Maryland.[75]
- **Maryland DNR's CoastSmart Communities Initiative** – Municipalities and counties in the coastal zone are eligible for up to $75,000 per year for a range of projects including those that address nonpoint source pollution, reduce vulnerability to sea level rise, or develop mechanisms to preserve natural resources.[76]
- **Maryland DNR's Chesapeake and Atlantic Coastal Bays Trust Fund** – Municipalities are eligible for funding under the program, which is aimed at maximizing nutrient and sediment reductions into Maryland's waterways by investing in a range of BMPs.[77]
- **Federal Emergency Management Agency Public Assistance and Hazard Mitigation Planning Funding** – The program offers grant funding to municipalities to implement long-term hazard mitigation efforts after a major disaster declaration.[78]

Stormwater Utility

A utility is an entity that collects fees for a specific purpose such as an electric utility, which collects fees for electricity provision and related services. Similarly, a stormwater utility would collect fees for the services provided by the stormwater

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[75] Federal Emergency Management Agency, 2013. National Flood Insurance Program Community Rating System. Available online: http://www.fema.gov/national-flood-insurance-program-community-rating-system.
[76] Maryland Department of Natural Resources, 2013. CoastSmart Communities Initiative. Available online: http://www.dnr.state.md.us/ccp/pdfs/CCIRequestforProposals2013.pdf.
[77] Maryland Department of Natural Resources, 2013. Chesapeake and Atlantic Coastal Bays Trust Fund. Available online: http://www.dnr.state.md.us/ccp/funding/pdfs/2012TrustFundSnapshot.pdf.
[78] Federal Emergency Management Agency, 2013. Hazard Mitigation Grant Program. Available online: http://www.fema.gov/hazard-mitigation-grant-program.

program including removal and management of stormwater coming from Oxford's public and private property.

A stormwater utility is a dedicated method of funding a stormwater program because the funds cannot be used for other purposes (e.g., general fund). A stormwater utility also generates revenue unlike bonds or loans, and is considered sustainable because the amount generated is roughly constant each year, unlike grants. Revenue collected under a stormwater utility could be used for any expense related to managing the stormwater program including personnel costs, public outreach and education, operations and maintenance, and stormwater related capital improvement projects.

There are 1,400 documented stormwater utilities in the United States including 8 in Maryland and 20 nationally in communities with fewer than 1,000 people.[79] In 2012, the town of Berlin in Worcester County (Pop. ~4,500) became the first Maryland, eastern shore community to adopt a stormwater utility. Stormwater utilities are typically structured to charge a recurring fee in tandem with the water and sewer bill (e.g., Oxford bills for water and sewer quarterly). The fee is often calculated based on how much stormwater is "produced" at a given property, which is a measurement of the amount of impervious surface on the property (land that does not permit the absorption of rainwater). Therefore, property owners are typically assessed a fee based on the portion of their property covered with roof space, driveways, patios, parking lots, and other paved surfaces that prevent rainwater from directly percolating into the land.

In 2012, the average annual residential stormwater fee in the U.S. was $55 (or $4.60 per month). The highest residential stormwater fee in the U.S. was $250 per month with other communities charging close to zero.[80] The fee set by a given community is often commensurate with the ongoing and projected expenses associated with its stormwater program, as well as the population size, and economic make-up of the community. All things being equal, communities with higher projected stormwater program costs (e.g., due to upcoming capital improvements) and communities with fewer properties across which to distribute program costs, have higher residential stormwater utility fees.

Equality is often a central concern in designing a stormwater utility. The utility should be structured in a way that rewards responsible landowners for managing stormwater and provides exemptions where necessary. Additionally, utilities are often progressive whereby the monthly fee for smaller properties with less impervious surface is set proportionally lower to larger properties with more impervious surface. This is usually accomplished through an equivalent residential

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[79] Western Kentucky Stormwater Utility Survey, 2013. Available online: http://www.wku.edu/engineering/civil/fpm/swusurvey/western_kentucky_university_swu_survey_2013.pdf.
[80] Ibid.

unit (ERU), which is the average amount of impervious surface on residential homes. Residential and commercial properties are then assessed a fee based on how much they deviate from the ERU.

There are a few disadvantages associated with stormwater utilities. First, few communities have impervious surface data readily available and calculating the amount on each property can be a costly endeavor. There are workarounds for this, however, which are discussed below. Second, the administrative work associated with setting up and maintaining a stormwater utility can be burdensome. Over time, the effort associated with administering the utility should decrease. Third, and most importantly, a stormwater utility fee asks citizens and businesses to contribute directly to the stormwater program – an additional cost beyond their existing public tax and fee burden. A new public fee will always face major opposition unless its purpose and expected impacts are clearly articulated. In turn, a realistic path to adopting a stormwater utility requires a lot of public outreach and education efforts.

Advantages	**Disadvantages**
- Reliable, consistent source of funding - The funds are dedicated towards improving the stormwater system and cannot be used for other purposes. - As opposed to a tax, the fee is paid in exchange for a particular service. - Fees can be structured to be equitable and unique to a community and its landowners. - By linking fees to the amount of impervious surface, utilities become an educational tool for teaching about the drivers of stormwater. - Utilities can be structured to have exemptions for low-income households and credits for responsible actors.	- Impervious surface data can be difficult or costly to acquire. - The administrative burden, especially in the first few years, is significant. - Gaining support for a stormwater utility requires public outreach and education efforts.

Loans and Bonds

Bonds and loans are an option for acquiring the upfront capital costs needed for a major capital improvement project. However, bonds and loans must be repaid with interest, which increases the overall cost of the project, and does not resolve the central issue of revenue to make payments. Bonds and loans are probably not the best option for Oxford unless the town decides it wants to implement a project

immediately, but needs several years to raise the necessary revenue through a modest utility fee. More favorable bond and loan terms could be found if Oxford had an established revenue generating mechanism in place prior to entering the market.

Blended Funding

In reality, most communities do not rely on a single funding option to manage their stormwater program, but instead use multiple options. In many cases blended funding allows the community to leverage financial resources towards additional resources. For example, communities will receive better loan terms with a stormwater utility in place to cover future payments at lower rates and grants applications are more competitive when communities have established their willingness to lead and share costs. In the case of communities in good financial standing, it may be advantageous to mix general funds and utility financing. By making a substantial investment from the general fund, a community can lower the utility fee for the community as a whole and demonstrate the town's commitment to managing stormwater and willingness to jumpstart its own stormwater program.

Chapter 6: Stormwater Utility Analysis

The project team is recommending the town of Oxford finance its stormwater program through blended funding including contributions from the town's general fund and a stormwater utility. The recommendation is grounded in the budget analysis (Chapter 4) and the expectation that Oxford will spend at least $.5 million on its stormwater program over the next five years. While Oxford could implement this low-cost stormwater program and finance it solely through its general fund, as the town has done in the past, this route is discouraged because (1) the low-cost budget does not significantly improve the high water situation, and (2) it weakens the town's financial position in the event of using up emergency funds or increases the probability of deferred stormwater maintenance thereby worsening high water conditions. By adopting a stormwater utility, Oxford would be in a position to (1) pursue a more ambitious and higher cost stormwater program capable of immediately addressing high water problems, or (2) begin saving for future projects that will address high water concerns through a capital reserve fund. The following chapter outlines how a stormwater utility might be structured and administered to sustainably and equitably finance Oxford's stormwater program in the future.

Utility Purpose and Goals

A stormwater utility in Oxford would be structured to meet the needs of the community. The chief goals of a stormwater utility would include the following tenants:

- The utility should be a dedicated, reliable, and equitable source of revenue;
- Utility revenue should be used for the purpose of meeting the annual costs associated with running the stormwater program including labor costs, capital improvement projects, and operation and maintenance;
- Surplus funds should be saved (e.g., in a capital reserve fund) to cover the anticipated costs of upcoming capital improvement projects;
- Surplus funds may also be used to cover emergency repair costs associated with the stormwater infrastructure;
- The utility should be used to leverage additional funding including grants and competitive loan rates;
- The utility revenue should be used to both reduce the frequency and severity of high water events as well as reduce water pollution; and
- The utility revenue should not be used for any other purpose and should be dedicated solely to managing the stormwater program.

The key difference between Oxford and many other community stormwater utilities is the role of controlling flooding from tidal and storm surge events. Spending limitations on stormwater utility revenue are standard – the funds may only be used to serve the stormwater program. However, one of the primary goals of any stormwater program, Oxford's in particular, is to reduce the frequency and severity of high water events. By limiting stormwater utility revenue to Oxford's stormwater

program, and by association only the stormwater infrastructure, Oxford would manage only a portion of the problem. Therefore, Oxford should relax these conventional spending limitations and allow for other expenditures that reduce the severity and frequency of high water events. Specifically, Oxford should broaden the definition of the utility to include shoreline protection or any activity that reduces the frequency and severity of flooding. In turn, we recommend Oxford label its utility to reflect this expanded functionality. We suggest naming the utility, "Oxford's Stormwater and Shoreline Protection Utility." The following goals or uses for the utility could be added to the list above:

- Utility revenue should be used to cover the cost of public shoreline improvement projects including design, materials, and installation only if they reduce the frequency and severity of high water;
- Utility revenue should be used to assist private landowners, as the predominant coastal user in Oxford, to improve stormwater management on their property or cover the costs of shoreline protection projects;
- Surplus funds will be saved to plan and used to prepare for long-term sea level rise impacts in the town of Oxford.

In summary, the town of Oxford should clearly define the purpose(s)of the utility, ideally including both stormwater management and shoreline protection. Moreover, the agreed upon utility purpose(s) should be accurately reflected in the utility name so that individuals and businesses paying the utility fee recognize the end goal.

Utility Rate Structure

Multiple utility rate structures were considered including (1) a flat fee, (2) an impervious surface based equivalent rate unit fee, and (3) a tiered commercial and residential fee. Criteria for evaluating the rate structures included practical constraints such as data availability and equitable distribution of costs across properties.

As a rule of thumb, stormwater utility fees should be tied to the amount of impervious surface on a property because impervious surface is a key driver of stormwater pollution and water accumulation (excluding tidal and storm surge influence). The flat fee, defined by its uniform rate across all properties, is disconnected from the amount of impervious surface on a property and therefore lacks accountability. The flat fee is also inequitable. For example, with 7 non-residential building structures in Oxford greater than 10,000 square feet in size and 89 residential building structures below 1,000 square feet, Oxford is too diverse a community for a flat fee to be defensible (see Table 11).

Next, we considered an equivalent rate unit fee structure based on the percentage of impervious cover. The primary dataset used to estimate impervious surface cover

on Oxford properties was 2011 Maryland tax assessment data.[81] The dataset includes every parcel in Oxford and variables such as land use type, parcel size, and size of primary structure (see Table 11). While the breadth and depth of data are sufficient to perform some thorough analysis, key variables related to impervious surface coverage are absent such as driveway and parking lot space. In turn, the best available method for calculating the percentage of impervious surface was the size of the primary building structure divided by the parcel size. Provided the absence of other impervious cover data, an inherent flaw in the method of estimation, and the suspect results, the impervious surface percentage based rate structure is not recommended. The current data limitations could be overcome through data collection (i.e., remote sensing of parcels), though the return on investment from such an endeavor would likely not be worthwhile for a small town the size of Oxford.

As a third option, a tiered residential and commercial utility fee was evaluated. This tiered system segments properties first by their use (i.e., residential vs. commercial), and then by the size of their primary structure – the best available proxy for impervious surface cover. The tiered system is more equitable than the flat fee system because it accounts for differences in impervious cover, and also has the advantage of having less cumbersome data requirements. Tiered stormwater utility fee systems are often applied to non-residential properties because non-residential properties typically exhibit a greater range of building sizes. For example, some communities have considered a flat residential fee and a tiered non-residential commercial fee. Oxford, however, has a wide range of residential building sizes and several homes larger than non-residential properties (see Table 11). A tiered non-residential and residential stormwater utility fee was evaluated for Oxford.

Table 11. Summary statistics for Oxford properties[82]

			Building structure size statistics (square feet)		
	Description	**# of Parcels**	**Min**	**Max**	**Mean** (Stand. Dev)
Non-Residential	Includes all commercial, industrial, municipal, churches, and the Oxford Lab	67	0	26,886	4,305 (5,734)
Residential	Includes all single family homes, apartments and residential condominiums	564	0	6,878	1,981 (1,149)

[81] Maryland State Department of Assessments and Taxations, 2011. Town of Oxford parcel data. Acquired from Maryland Property Viewer.
[82] Ibid.

Tiered Residential and Non-Residential Utility Fee

The proposed utility fee would first be segmented by residential and non-residential property types and then tiered by primary building size (see Table 12). The fee would be assessed on an annual basis for each property and the cost to any single property would be a function of the property type, the primary building size, and the base fee. The total size of the property or the number of buildings on a given property would be irrelevant – the fee would be determined by the size of the primary building. While the tiered utility structure would be constant to ensure equability and accountability (i.e., the two types of properties and building ranges within), the base fee would be variable and should be set to a level that will meet necessary stormwater program expenditures. Given the forecasted stormwater program costs, the base fee should be set between $100-200 per property per year (discussed further below).

For example, residential property owners with average-sized homes (i.e., 1,000-4,000 square feet) would be assessed the base fee while property owners with a primary building below 1,000 square feet in size would be assessed half the base fee, and property owners with a primary building above 4,000 square feet in size would be assessed one-and-a-half times the base fee. On the non-residential side, property owners would be assessed the base fee if their primary building structure is under 4,000 square feet in size, two times the base fee if their primary building structure is between 4,000-10,000 square feet in size, and three times the base fee if their primary building structure is over 10,000 square feet in size. For example, with a base fee of $175, a residential property with a 2,500 square foot home would be asked to pay $175 per year and a non-residential property with a primary building 7,000 square feet in size would be asked to pay $350 per year.

Table 12. Proposed utility structure and expected annual revenue by property type and base fee

			Base Fee – Cost per Year			
	Number of Parcels	Multi-plier	$125	$150	$175	$200
Residential Properties (Primary Building Structure)						
< 1,000 sq. ft.	89	.5	$5,563	$6,675	$7,788	$8,900
1,000-4,000 sq. ft.	448	1	$56,000	$67,200	$78,400	$89,600
> 4,000 sq. f.t	27	1.5	$5,063	$6,075	$7,088	$8,100
Non-Residential Properties* (Primary Building Structure)						
<4,000 sq. ft.	22	1	$2,750	$3,300	$3,850	$4,400
4,000-10,000 sq. ft.	14	2	$3,500	$4,200	$4,900	$5,600
> 10,000 sq. ft.	7	3	$2,625	$3,150	$3,675	$4,200
Total Annual Revenue, Residential + Non-Res.			**$69,938**	**$83,925**	**$97,913**	**$111,900**

* Excludes Oxford-owned property

As designed, the stormwater utility fee would be assessed against all Oxford properties except for the 24 community-owned properties including parks and buildings. Removing town of Oxford-owned property from the utility eliminates the

need for the town to assess a fee against itself and collect it from itself, which increases administrative burden. The town of Oxford should pay its fair share; however, and could do so through general fund contributions (see discussion below).

Under the current structure and distribution of parcel types, residential properties would contribute about 87 percent of total payments and non-residential the differences. Given close to 89 percent of parcels in Oxford are defined as residential properties (i.e., single family homes, condominiums, or apartments), a heavy skew towards residential payments is expected.

Anticipated Revenue

The total amount of funds available for Oxford's stormwater program and related services would be dependent on the base fee selected for the stormwater and shoreline protection utility and the contribution from Oxford's general fund. Considering only the revenue from the utility, Oxford could generate between $56,000 and $112,000 annually, respective to a $100 and $200 base fee (see Table 12). At a base utility fee of $125 plus a $60,000 annual contribution from Oxford's general fund, approximately $650,000 would be generated over 5-years or enough to cover the $630,000 option 2 above (see table 10). Without grant support or debt financing, Oxford would be hard-pressed to finance a 5-year stormwater program budget at or above $1 million (see table 10). To do so, the town would need to contribute significantly more from the general fund and set the base utility fee above $200 per year. Ultimately, the utility base fee should be commensurate with the services and goals the Oxford community expects from its' stormwater program. Specific recommendations for where to set the utility base fee and general fund contributions are presented in Chapter 7.

Table 13. Revenue generation scenarios for Oxford

Utility Base Fee ($/house/year)	Utility Contribution ($/year)	General Fund Contribution ($/year)	# of Years	Revenue (after # of years)
$125	$70,000	$0	5	$350,000
$100	$56,000	$60,000	5	$580,000
$125	$70,000	$60,000	5	$650,000
$175	$98,000	$100,000	5	$990,000
$125	$70,000	$60,000	10	$1,300,000
$175	$98,000	$100,000	8	$1,580,000

Utility Administration

In addition to the utility purpose and structure are issues of administration. Specifically, the utility should be flexible to account for responsible behavior as well as financial hardship, should have a straightforward and predictable billing mechanism, and should be enforceable.

Exemptions and Credits

There is precedent for stormwater utilities with exemptions and credits. Select property owners may be exempt from utility payments due to the property type or claims of financial hardship. Our recommendation is to require all properties in Oxford to pay the utility including the Cooperative Oxford Laboratory and places of worship. Town of Oxford-owned property, though technically exempt, will pay its fair share via general fund contributions. If the town elects to allow exemptions, they should be allowed on the basis of financial hardship. The simplest way to implement a financial hardship exemption would be to parallel the Chesapeake Bay Restoration fee exemption and allow any property owner exempt from those payments, to also be exempt from the Oxford stormwater utility. As of fall 2013, no Oxford property owners had claimed an exemption for the Chesapeake Bay Restoration fee.[83]

More productive than exemptions would be the inclusion of credits in the stormwater utility. Credits would allow property owners that take responsible actions towards managing stormwater to receive discounts on their annual stormwater utility fee. For example, for every stormwater BMP implemented on a property (e.g., rain barrel, rain garden), the property owner gets his or her fee reduced by some amount. Utility credits encourage responsible stormwater stewardship and serve an important educational role. Credits can be structured in a variety ways and could be introduced after the initial rollout of the stormwater utility.

Billing and Enforcement

There are at least two options for requesting payment of the stormwater utility fee. One option would be to tie payment to the quarterly sewer and water bill, and break payment of the stormwater utility fee into quarters. Due to the impending increases in Oxford's water and sewer bills (see Chapter 2), adding payment of the stormwater utility alongside would make for a dramatic sticker shock in the town. The other option would be a stand alone, annual stormwater utility bill. This would add to the amount of mail residents and businesses receive as well as create additional administrative work for the town of Oxford. However, this option has the advantage of being focused solely on stormwater and shoreline protection and could be an opportunity for an annual stormwater newsletter, raising awareness of projects due to be completed in the coming year and educational as well as participation opportunities for citizens looking to manage stormwater on their property. There is also the question of enforcement or how to deal with nonpayment. Under the first option, nonpayment would result in the disruption of water-related services. Under the second option (the stand alone, annual bill), the

[83] Personal Communication with Cheryl Lewis, town administrator. Telephone call on September 17, 2013.

town has few tools at its disposal to discourage nonpayment. One solution to this problem; however, could be to post the names of those individuals who did not pay in the town office or newspaper.

Chapter 7: Conclusion and Recommendations

There are four actionable findings for the town of Oxford regarding its stormwater program:

1) The frequency and severity of high water events can be mitigated through a comprehensive stormwater program and related capital improvement projects;
2) Oxford must also address shoreline protection to manage the influence of tidal and storm events as well as anticipated sea level rise;
3) Oxford can elect to operate a low cost, low impact stormwater program or a high cost, high impact stormwater program, and everything in between. The community and elected officials must decide how much they are willing to pay for increased protection from high water events and decreased runoff pollution.
4) Oxford can finance its stormwater program and necessary capital improvement projects through general funding, grant funding, a stormwater utility, and/or a combination of these.

Recommendations for the Town of Oxford

After collecting significant stormwater management data; organizing many outreach activities that helped gather important feedback from the community; followed by a detailed analysis of possible solutions and associated costs, five key recommendations were developed for the town of Oxford. Project findings and recommendations were presented to Oxford residents, businesses, and officials on September 24 and 25, 2013. The recommendations include:

- **Adopt a more effective stormwater budget:** Approximately $630,000 over a five-year timeframe is needed to invest in stormwater management for the town of Oxford. This amount includes currently planned capital improvement projects, a stormwater infrastructure inventory and map, as well as a stormwater Master Plan. Oxford should also consider budgeting for additional major capital improvement projects in the next 5-8 years for such things as Causeway stormwater pumps combined with a road elevation project, which will address an area of priority concern at a total five-year budget of approximately $1.5 million.

- **Account for projected sea level rise:** With the Chesapeake Bay projected to rise between 2.6 and 4.3 feet by 2100 at an average rate of 0.35 inches/year, Oxford should factor sea level rise projections into all major capital improvement projects. As an additional precaution, Oxford should assume some additional costs in their future budget projections for sea level rise and land subsidence. Furthermore, the town should evaluate its response to sea level rise beyond the scope of its stormwater program.

- **Establish a utility as part of a blended financing strategy:** Oxford should adopt a tiered residential and commercial stormwater utility fee as a consistent, dedicated, and equitable form of revenue to cover program costs. The utility should be supplemented by general funds and could be used as a way to leverage additional grant funding and/or competitive loan rates.

- **Designate an appropriate utility purpose and label:** Given that the frequency and severity of high water events cannot be resolved solely through a traditional stormwater program, Oxford should broaden the definition and functionality of the utility to include shoreline protection. The revenue collected through the utility should address both stormwater and shoreline drivers of high water events and water pollution. The name of the utility should reflect the multi-functionality of the revenue collected, thus allowing projects to be appropriately funded through this financing mechanism.

- **Utility structure and reserve fund:** It is recommended that the town of Oxford adopt a base utility fee of $175/home/year and that an additional $100,000/year, which is currently spread across multiple line items, be allocated to the stormwater program from the general fund. This would raise approximately $990,000 over a five-year period.

The next step for the town of Oxford is to expand the ongoing stormwater and flood management dialogue to the broader community and to deliberate on the recommendations presented in this report. The town of Oxford has a unique opportunity to be proactive and innovative in its approach to addressing high water events and stormwater and to establish itself as a statewide leader while assuring residents and businesses in the Oxford community will continue to thrive.

Goals for Oxford's Stormwater Program

Out of the project came a clearer sense of purpose and process for Oxford's stormwater program. The language below, written by the University of Maryland EFC, presents recommended goals and guiding principles for the town of Oxford to consider in managing their stormwater program.

End Goal: Reduce pollution attributable to stormwater as well as the severity and frequency of high water events by (1) ensuring the public stormwater system is optimally designed and performing at a high level, and (2) increasing private efforts to control stormwater through education and outreach.

Planning for a Sustainable Oxford Stormwater System:

- **Catalyze**: Raise topic awareness and community expectations by stating goals, soliciting citizen feedback, and investing the town's funds and labor.
- **Measure and Evaluate**: Identify, inspect, and map all Oxford stormwater infrastructure including inlets, culverts, tide gates and outfalls; pinpoint sources and quantities of pollution.
- **Plan and Prioritize**: Develop a Stormwater Master Plan that will strategically implement projects capable of reducing the severity and frequency of flooding as well as mitigate pollution loading.
- **Budget and Implement**: Make stormwater planning and associated capital improvement projects a regular, on-going component of the budget process.
- **Sustainable and Equitable Financing**: Do not rely on grant-funding or long-term debt to meet program goals; begin saving and/or generating revenue to finance the program and ensure the distribution of costs is equitable.
- **Tracking and Training**: Institute a process for regularly tracking and assessing the stormwater system and program implementation; train Oxford staff in all necessary skills and technology to ensure ongoing improvement.
- **Outreach and Education**: Develop and deliver relevant stormwater management information to homeowners and businesses through town efforts, volunteers, and community partnerships.

Project Team

Joanne Throwe, Director, EFC

Hired in 2005 as the EFC's Agricultural Program Leader, Joanne Throwe became Assistant Director in 2007, Associate Director in 2008, and Director in 2009. In addition, she completed an 18-month assignment working with USDA/CSREES as shared-faculty to assist in the coordination of special agriculture projects. Ms. Throwe works with communities in the Mid-Atlantic region implementing innovative financing solutions for environmental protection. Her work experience includes extensive knowledge about agriculture, green infrastructure, biofuels, ecosystem services and solid waste management. Prior to joining the EFC, Ms. Throwe spent several years as a Development Resource Specialist at USDA's Foreign Agriculture Service and two years as an Agriculture Extension Agent for Peace Corps in the South Pacific. She holds a M.A. in Public Policy and Private Enterprise from the University of Maryland.

Sean Williamson, Program Manager, EFC

Sean Williamson joined the EFC in 2012 and manages energy and climate change work. Sean is actively involved in the Maryland Smart Energy Communities program, University System of Maryland greenhouse gas analysis, and stormwater management projects at the Center. Prior to joining EFC, Sean worked at the Center for Integrative Environmental Research at the University of Maryland where he researched renewable energy, greenhouse gas reduction policies, and ecological economics. Sean strives to make data-driven decision-making and clear communication the central components of his work with communities and stakeholders. He graduated from the University of Maryland School of Public Policy with a Master of Public Policy and holds a Bachelor of Science from Cornell University.

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